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Measuring city commitment to climate change mitigation

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MEASURING CITY COMMITMENT TO CLIMATE CHANGE MITIGATION

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ABSTRACT

An increasing number of cities are focusing on sustainability and climate change mitigation by joining groups such the International Council for Local Environmental Initiatives (ICLEI). ICLEI uses a five-step milestone process to help cities achieve their mitigation goals. These milestones include conducting a greenhouse gas inventory, setting reduction targets, creating a Climate Action Plan, and implementing and monitoring that plan. Prior studies have examined factors that may influence a city's decision to join ICLEI, but few have looked at how committed the cities are to sustainability and to ICLEI itself after joining the organization. The purpose of this study is to uncover why some member cities show a greater commitment to the ICLEI program than others. Commitment to climate change mitigation was measured by the number of ICLEI program milestones achieved by 257 member cities. Fifteen independent variables covering socioeconomic conditions, local residents' attitudes, climate stress, and location were included in a principal components analysis, chi-square test, and multiple regression analysis to identify key factors that may explain variation in level of commitment to climate change mitigation. The results show that the number of years a city has been an ICLEI member has a positive effect on milestone attainment, while the levels of car dependency and hazardous air pollutants have negative effects. In other words, member cities with higher levels of hazardous air pollution and greater dependence on automobiles had achieved fewer ICLEI milestones than cities with lower levels of climate stress. These findings are useful not only in evaluating the effectiveness of ICLEI, but in yielding better understanding of the varied environmental, cultural and socioeconomic contexts of member cities. The insights have implications for ICLEI and other similar organizations that may need to target member cities facing more significant challenges in meeting program goals with additional technical assistance and support to help them achieve meaningful local climate change mitigation.

CHAPTER 1: INTRODUCTION

Since the early 1990's, an increasing number of cities and counties in the US have been implementing sustainability goals. In the absence of any substantive national or international agreements on limiting greenhouse gas emissions, some cities have decided to combat climate change on their own at the local level (Sharp, Daley, & Lynch 2011). A decentralized, city-scale approach is a relatively new way for local governments to take concrete, meaningful actions to reduce carbon emissions. Local governments have the potential to succeed where larger initiatives failed (Toly 2008). This local-level control allows cities to act immediately and to implement climate change mitigation measures in a manner that is best suited for their city (Lindseth 2007).

Why would cities bother to try and mitigate their impacts on climate change? Even if a city produced zero carbon emissions, it would have no effect on global levels of carbon. Rationally, it does not make sense for a city to try and reduce carbon emissions because greenhouse gases are global pollutants. A reduction in emissions from City A will reduce overall global emissions, but it will have little effect on the local climate of City A if Cities B, C, D, and so on do not also reduce their emissions. This loophole can encourage cities to end up free-riding on the accomplishments of other cities, instead of implementing their own carbon-reduction measures (Engel & Orbach 2008). The same phenomenon happens at the international level, with the reductions from some countries having little effect due to increasing emissions from other countries (Peterson 2008). Climate change is also usually framed as a global problem, and the common wisdom implies that a global solution is needed to effectively combat it (Rabe 2010; Toly 2008). Unfortunately, it may be too late for a global agreement. The yearly United Nations conferences that started with the Earth Summit in 1992 have been unable to provide a binding, global solution, and greenhouse gas emissions have only skyrocketed since then (Hansen 2009). Despite the recent increase in public attention to

climate change, actual progress towards forging agreements and reducing emissions has stalled (Dimitrov 2010).

When faced with these problems, cities may not seem like the most logical level of government to tackle a global problem such as climate change. Cities have jurisdiction over only a very small land area, and the number of people living in a particular city is inconsequential when compared to the entire world population. Many researchers argue that while local actions are noble, they will not have a strong overall impact because the scale of local actions is just too small (Wiener 2006; Rabe 2010). However, since the national and international levels have had little success in implementing the Kyoto Protocol or a cap-and-trade system on a worldwide scale, attention needs to be paid to the local governments that are working to reduce their emissions. Their efforts should not be ignored or derided as essentially useless. A single city cannot hope to stop climate change by itself, but if enough cities are involved then they can have a cumulative impact that is global in nature. Over half of the world's population now lives in urban areas, and many of the activities that lead to the emission of greenhouse gases emanate from cities (Betsill 2001; Toly 2008). This number is even higher in the US, with 82% of Americans living in either a city or the suburbs (Central Intelligence Agency 2012). Krause (2011) notes that many of the driving forces and impacts of climate change stem from local activities, and that therefore it does not make sense to completely discount the ability of local actions to have a global effect. Lutsey and Sperling (2008) calculated that if all of the state and city emissions targets in place (as of 2008) were achieved, US emissions could be stabilized at 2010 levels as soon as 2020. This is a substantial impact, and all of it could be accomplished without federal mandates.

Cities can take many actions to reduce their carbon emissions. The easiest first steps include measures such as installing LED lighting, retrofitting buildings, and conserving energy (Betsill 2000).

Beyond those initial actions, cities can focus on the larger scale and evaluate their land-use and transportation decisions (Linstroth & Bell 2007). Many of these cities make formal and informal commitments to reduce their emissions and draft energy, transportation, or climate action plans. It is important to keep in mind, though, that not all climate mitigation measures are equal. Many cities may have agreed in theory to work towards carbon reduction, but they may not actually be making progress towards those goals. These goals are often only symbolic statements, since the largest greenhouse gas targets are not set to be completed until 2040 or 2050, long after the politicians who signed the documents are out of office (Krause 2011). This makes it necessary to find a way of comparing not just the greenhouse gas reduction goals, but the extent to which those goals are actually being implemented.

Cities that want to work on climate change mitigation can either choose to reduce emissions by themselves, or they can join an organization that has common goals and targets for emission reduction. These organizations include the Mayor's Climate Protection Plan (MCPA) and the Cities for Climate Protection campaign (CCP) that is run through ICLEI (International Council for Local Environmental Initiatives). The MCPA was formed in 2005 by then-mayor of Seattle Greg Nickels. The CCP program is managed by ICLEI and has been in operation for almost 20 years. There are currently more than 1,000 cities that are part of the MCPA, and more than 600 in ICLEI. Membership in these groups has expanded dramatically in just the past few years – in 2005 ICLEI had 164 US members, but by 2012 it had over 600 members. Worldwide, ICLEI has more than 1,200 members. Some cities are members of both organizations, but combined they still account for 5% of all US cities and 30% of the population (Krause 2011). This means that 30% of the population of the US lives in a city that has formally committed to reducing its carbon emissions.

However, the two groups are not equal in terms of measuring commitment to carbon reduction. The MCPA only requires a city's mayor to sign the agreement and does not have a way of enforcing or tracking those agreements (Bailey 2007). ICLEI introduces accountability into its program through the milestone process, which is a set of five goals that the cities are trying to achieve (ICLEI USA 2011). The five milestones are:

1. Conduct an emissions inventory
2. Adopt an emissions reduction target
3. Develop a Local Climate Action Plan
4. Implement the Plan
5. Monitor and verify the results.

These milestones introduce uniformity into the system and allow each city to be compared using the same ranking process. Joining ICLEI allows a city to work towards voluntary carbon reductions while obtaining technical assistance and feedback from ICLEI.

There is large amount of literature that focuses on why a city would voluntarily choose to limit its carbon emissions by joining a group such as ICLEI (Bailey 2007; Betsill 2001; Vasi 2006). These studies utilize case studies, surveys, and statistical techniques to search for the underlying factors that influence the adoption of climate mitigation plans. Several of these studies have focused on ICLEI, and within that frame they usually focus on the variables that affect a city's decision to join ICLEI. The purpose of this research is to determine what variables account for a city having reached more ICLEI milestones. This is similar to studies that look at underlying factors for why a city adopts a climate action plan or other mitigation methods (Boswell, Greve, & Seale 2010; Feiock, Francis, & Kassekert 2010; Portney 2003). Many of these studies have conducted surveys with city managers or counted the number of green initiatives that a city has in place, but it is sometimes difficult to compare these results because the items being measured are not uniform across cities.

This study will look not at what factors account for a city choosing to adopt a plan, but the factors that account for them actually making concrete progress on achieving the goals. The underlying research questions are: What factors account for some cities being more committed to alleviating climate change than other cities? Why have some cities reached more ICLEI milestones than other cities?

To do this ICLEI's five milestones will be used for measuring climate commitment. This research looks specifically at ICLEI cities that all have the same baseline to be measured by – the milestone scale. Only one other study (Sharp et al. 2011) looks specifically at those five milestones to measure a city's commitment to ICLEI. Using the milestones assures that all the cities are being measured from the same baseline and the same sequence of steps. There is still some variability in the process because the milestones do not specify what elements must be included in a city's climate action plan, but the overall sequence of steps is the same for each city. ICLEI measures everyone according to the same basic benchmarks, ensuring that there is at least some uniformity in the mitigation actions.

Fifteen separate variables will be examined to see how they relate to the number of ICLEI milestones that a city has achieved. These variables include socioeconomic factors, the climate stress of cities, environmental attitudes of the city and region, and the geographic location of cities. Almost all of these variables have been used in research looking at ICLEI adoption, but not all of them have been used to measure ICLEI commitment. A multiple regression analysis, a principal component analysis, and a chi-square test will be used to look at the relationship between how committed a city is to climate change and what variables underlie that commitment. This research fills a gap in the literature, because commitment to climate change mitigation and the ICLEI program has not been as extensively studied as the factors that influence a city's decision to join

ICLEI. This research will expand upon that topic by searching for the specific factors that have an influence on the level of commitment to ICLEI.

CHAPTER 2: LITERATURE REVIEW

2.1 Levels of Action

Climate change first became known as a potentially serious threat during the 1980's. Since that time, mitigation has been attempted on almost every level imaginable - international, national, regional, state, and city/county – with varying rates of success.

2.1.1 International

One of the first broad international attempts at mitigation was the 1992 Framework Convention on Climate Change at the Earth Summit (Wiener 2002). 154 nations agreed to stabilize emissions at non-dangerous levels by 2000, although this exact value of "non-dangerous levels" was never clarified. The first President Bush attended this conference, but the US delegation was opposed to strict emissions-control methods (Rosencranz 2002). It was still widely believed that the US would work towards climate mitigation, potentially by joining the Kyoto Protocol in 1997. The Protocol was an international agreement that covered the six major greenhouse gases, and utilized new regulation measures aimed at increasing technology transfer between developed and developing nations. This accord had different emission reduction goals for different countries, and the goal for the US was to reduce its' greenhouse gas emissions to 7% lower than 1990 levels by 2012. However, the United States did not ratify the protocol because it omitted developing countries from reducing their emissions (Wiener 2002). The Conferences of the Parties have continued on a yearly basis with few concrete results. There was potential for the 2009 conference in Copenhagen to succeed because it was the last conference that could update the Kyoto Protocol, but the resulting Copenhagen Accord was non-binding. The developed and developing countries were once again unable to reach agreement on the differentiated responsibilities of each group

(Armeni 2010). This failure of this conference highlights the apparent inadequacy of the international community to agree on a method of mitigating climate change.

2.1.2 National

There are numerous options for regulating greenhouse gases within the US. These options include a carbon tax, cap-and-trade, and EPA regulation. A carbon tax is seen to be the best method from an economic standpoint (Kasterine & Vanzetti 2010), but this has been a difficult method politically. The method that came the closest to being implemented was a cap-and-trade system. This system was used to successfully control acid rain, especially in the Midwest and Northeast (Vig & Kraft 2010). Throughout the 2000's numerous bills calling for a nationwide cap-and-trade system were brought forth in both the House and the Senate, but none of these bills passed (Byrne et al. 2006). The bill that came the closest was the Waxman-Markey bill of 2009. This legislation would have established an emissions trading plan similar to the one in use in the European Union, and would have resulted in a 17% reduction from 2005 levels by 2020. It also specified that 85% of the initial allowances would be auctioned off for free, which was a major concession to industry that was not included in previous bills (Resources for the Future 2010).

EPA regulation has had somewhat more success than the cap-and-trade bills. In *Massachusetts v. EPA (2007)*, it was determined that the EPA has authority to regulate greenhouse gases if they are found to endanger human health. Implementation of a regulation scheme has been slow and bogged down with legal challenges. A framework for regulation was put into place in 2010, but most small sources of emissions are omitted for the foreseeable future (US EPA 2011), which weakens the overall impact of the regulations.

2.1.3 Regional

Several regional groups have sprouted in recent years, including the Regional Greenhouse Gas Initiative (RGGI) and Western Climate Initiative (WCI). Both groups consist of member states and Canadian provinces as well as observer states that are not formally committed. They both focus on specific greenhouse gas reduction targets to be achieved through a cap-and-trade system (Benson 2010).

The RGGI has been the most successful of the two groups to date. It consists of nine Mid-Atlantic and northeastern states, with three provinces and Pennsylvania as observers. Thus far, the program involves only power plants with at least 25 MW of generating capacity and aims to reduce emissions from these plants by 10% by 2018 (Byrne, Hughes, Rickerson, & Kurdgelashvili 2007). Auctioning of emissions permits began in 2008, and the first 3-year compliance period began in January 2009. In this initial phase some of the states have realized that they allowed too many permits to be auctioned, resulting in little actual reductions. The states are now focusing on reducing the number of permits so that all the permits are sold and used. It is widely expected that the cap will be further lowered at the end of the review period in summer 2012 (Navarro 2012). Despite some setbacks, including the departure of New Jersey in 2011 and the oversupply of initial permits, the RGGI appears to have had the most success so far in implementing a program and achieving results.

In 2007 the WCI set a goal of a 15% reduction from 2005 emission levels by 2020. By 2008 this group had expanded to include seven states and four provinces, with an additional 13 states, Mexican states, and provinces having observer status. The member states accounted for 20% of total US GDP and a stunning 76% of Canadian GDP, since the economic powerhouse provinces of Ontario, Quebec, and British Columbia were involved (WCI 2010). Despite this early expansion, in

2011 all of the states except for California left the WCI in order to delay implementation of the cap-and-trade program. This departure was also prompted by the economic recession and subsequent lack of funds for program implementation. The effectiveness of the WCI has been severely diminished by this mass departure, and it remains to be seen if California and the four provinces can successfully continue the WCI (Hamilton 2011).

2.1.4 State

The state level has the ability to implement climate change mitigation on a smaller scale than the federal government, but still at a substantially larger level than the city, especially for states such as California and Texas. States have already been taking up the slack in the broader environmental arena. 75% of current federal environmental programs can be delegated to the states, and states often have the ability to give out permits for environmental projects (Rabe 2010). The larger states have a large liability when it comes to carbon emissions. If all 50 states were separate nations, 18 states would rank in the top 50 of worldwide carbon emitters. Texas alone emits more than the entire United Kingdom, despite having 37 million fewer residents (Rabe 2010).

Thirty-six states currently have some sort of climate action plan in place (Pew Center on Global Climate Change 2011). These plans cover a wide range of policy options and levels of commitment. The stringency of these plans varies considerably by state. Many plans merely state what could be done to reduce greenhouse gas emissions, with no mention of how to ensure that those recommendations are actually followed.

Beyond formal climate action plans, there are numerous climate mitigation measures that states can implement. These include renewable portfolio standards, electric power plant emission standards, adaptation plans, green building policies, and greenhouse gas registries. However, state implementation of these measures is often highly uneven. Some states consistently implement

more environmental measures, while other states almost never do. This is also the case for some of the high-achieving cities across the nation. This difference can lead to industries choosing to relocate to states with less strict standards, and thus overall carbon emissions are not reduced (Wiener 2007). Once most states have carbon reduction measures in place, this carbon leakage becomes less likely.

With the notable exception of California, it appears that most state climate action measures have had minimal results. In 2006 the state passed the California Global Warming Solutions Act of 2006 (Engel & Orbach 2008). This plan commits to a 25% reduction in greenhouse gas emissions by 2020, although there is some question as to whether that plan is still being followed after the economic downturn and change of governership. California has also adopted emissions targets for cars and light-duty trucks. These targets are likely to have stronger impacts than any from a climate plan because California is such a huge market for auto companies, thus forcing them to build their cars to those state standards. Twelve states to date have also adopted the California standards (Engel & Orbach 2008).

2.1.5 City/County

The local level is a relatively new level for climate change innovation. Cities, counties, and even universities have increasingly been interested in the part that they can play in mitigating climate change. The aim of local programs is to involve cities in mitigating climate change through local governments. This allows cities to start having an immediate impact on reducing their carbon emissions without having to wait for larger agreements such as the Kyoto Protocol to be ratified or a national cap-and-trade system to be implemented. Two of the most prominent organizations that bring these cities and counties together are the Mayor's Climate Protection Plan (MCPA) and ICLEI's Cities for Climate Protection campaign (CCP).

The MCPA is sponsored through the US Conference of Mayors. This program was proposed by Seattle mayor Greg Nickels in 2005, and advocated a 7% reduction in emissions from 1990 levels by 2012, the same as the original Kyoto Protocol targets. The MCPA also focuses on encouraging state governments to adopt the Kyoto targets and urging Congress to pass carbon emission regulation (Linstroth & Bell 2007). While this group currently has 1054 mayors who have signed on, the program has been largely ineffectual (Engel & Orbach 2008). Ratification is completely voluntary, and there is no mechanism that ensures that mayors and cities are actually following through with their pledges (Bailey 2007). It is also difficult to compare the progress that the cities make, since there is no standard method used to calculate greenhouse gas emissions and reductions (Bailey 2007). Bailey's 2007 study, which looked at the 355 cities that were MCPA signatories at that time, shows that every city except Portland, Oregon, has actually increased their overall emissions. The MCPA is certainly a bold statement for a city to make, and it does bring climate change issues into the public view, but to be effective it needs to hold those cities accountable in some way.

The CCP program, initiated in 1991 by ICLEI, has been more successful. ICLEI brings local-level governments together to work towards sustainability and climate mitigation. ICLEI was founded during the World Congress of Local Governments for a Sustainable Future at the United Nations in 1990. The international headquarters are in Bonn, Germany, and the US headquarters are in Oakland, CA. ICLEI USA is funded by a variety of private and public organizations, including the EPA, the State Department, and the Kaiser Foundation (ICLEI USA 2012).

ICLEI currently has over 1,200 cities worldwide, with 600 of those located in the US. ICLEI operates quite differently from the MCPA. It has five climate change planning goals that cities must try to meet, and they are rated by how many of these goals they have met. This introduces accountability into the system, since each city is judged on the same basic steps instead of on

pledges that have no enforcement mechanism. ICLEI also provides technical information on how to conduct an emissions inventory and set reduction targets for Milestones 1 and 2 and has extensive support services for city officials to contact. A main selling point for ICLEI is that it provides software that helps cities track and analyze their greenhouse gas emissions once they reach Milestones 4 and 5. These software tools come with trainings on how to use them, and city planners can also access webinars on technical issues and general climate change news. Because of its success in marketing climate mitigation to cities, ICLEI is now branching out into a climate resiliency and adaptation program and an overall sustainability program based on the climate change program (ICLEI USA 2012).

2.2 Cities and Climate Change

Given the current level of inaction at the federal level, it makes sense that states and cities are now trying to find ways to reduce their greenhouse gas emissions by joining programs like ICLEI and the MCPA. Although the exact number is uncertain, some studies have found that 78% of global CO_2 emissions can directly or indirectly be attributed to cities (Betsill 2000). These direct emissions can come from transportation, industry, land use, electricity, and other related activities. Indirect emissions can arise from almost every product that is used within a city, including the emissions produced in growing the food crops that are sold and consumed in the city, and the emissions from creating consumer products for the city (Wiedmann & Minx 2008). Cities cannot control all of these external emissions, but they do have the potential to drastically reduce their emissions because they have more control over energy supply and management, transportation, land-use planning, building requirements, and waste management (Bulkeley 2003). This allows city governments to make specific policy choices that can be tailored to the needs and capabilities of their city (Lindseth 2007).

2.2.1 Advantages of City-Level Action

There is some evidence that cities can be more effective test cases for climate mitigation measures than larger entities such as countries. Cities are at a much smaller scale, so theoretically they can experiment with different measures and technologies and change course more quickly than an entire nation can. This flexibility also allows cities to tailor solutions to their own unique local circumstances (Lutsey & Sperling 2008). This local-level tinkering can act as a testing ground for potential national policies and technologies, discovering which techniques might be applicable to the country as a whole (Linstroth & Bell 2007). Conversely, if a certain method does not work, that can be a cautionary lesson for other cities and countries.

There are several practical reasons for a city to take action on climate change. Many actions are relatively easy to implement and can end up saving the city money in the long run. Hybrid vehicles and LED lighting are more efficient and use less energy than traditional vehicles and lights. They may cost more at first, but over time the city will reap the economic benefits (Betsill 2000; Kousky & Schneider 2003). Many cities also frame climate action as a problem of air pollution or suburban sprawl. Decreasing pollution, reducing sprawl, and enhancing liveability are immediate co-benefits of CO_2 reduction. This helps to frame the problem as not merely an environmental or political problem, but as a solution that will benefit all aspects of the city. These types of no-regrets actions are often included in a city's Local Climate Action Plan and are the easiest actions for cities to take, because these actions would benefit the city even if climate change were not a concern (Linstroth & Bell 2007).

Cities often join to gain some sort of intangible benefit. Many cities like to prove their green credentials, both to their own citizens and to other cities. Publicly committing to ICLEI is one way for a city and its leaders to gain political goals and accolades (Betsill 2000; Engel & Orbach 2008). Cities

also need to be responsive to the wishes of their citizens. Multiple studies have found that cities with more citizens interested in environmental issues are more likely to take proactive steps with regards to climate change (Zahran, Brody, Vedlitz, Grover, & Miller 2008a; Pitt 2010). Cities that have a history of engaging on environmental issues in general are likely to have environmentally-minded citizens, and therefore are more likely to join ICLEI (Betsill 2000).

2.2.2 Obstacles to City-Level Action

Despite these incentives to act, it is still difficult for most cities to even consider climate mitigation. Only a select number of cities have committed to the ICLEI campaign, and even fewer are actually making progress on their goals. For most cities, the obstacles to joining are greater than the perceived benefits.

Betsill (2000) has identified four main reasons that make it difficult for a city to rationally commit to a climate mitigation program. Cities will be affected by climate change regardless of whether or not they work to mitigate it; the costs of mitigation are disproportionately higher than the benefits when participation is voluntary; the collective benefits of mitigation will go to both participating and non-participating cities; and there is no significant federal assistance for climate change protection planning. These factors make it difficult for a rational city government to commit resources and time to a project that very likely will have no effect on climate change in their region. Additionally, the thought of being able to free-ride off of others, or having other cities free-ride on them, can dissuade many city officials from joining a climate mitigation program. Wiener (2007) posits that local action might actually have a negative effect on overall CO_2 emissions. Cities that encourage green practices in industry and manufacturing might push away that type of business into another city or region, a region that perhaps does not require any sort of environmental standards. This “leakage” could increase CO_2 emissions instead of decreasing them.

There are also basic institutional deficiencies when trying to adapt to or mitigate climate change. According to Bulkeley (2003), the internal characteristics of the city government are often the most important determinants of climate commitment. The availability of funding, the presence of a committed individual within the government, the political will to act, and local power over energy and transportation are all crucial factors. Feiock et al. (2010) found that a mayor-council government had a negative effect on sustainability within the city government itself, but a positive effect on community-wide sustainability. Most city governments are not organized in a way that is favorable to interdisciplinary problems such as climate change. It is often difficult to get transportation, waste management, public works, utilities, and other departments to collaborate outside of their specific duties, especially when a department is already understaffed. A potential solution to this problem, for cities that are truly serious about mitigating climate change, is to create a department that can simultaneously handle all of the sectors. Portland, Oregon chose this path by creating an Office of Sustainable Development that merged the former solid waste and recycling program, the energy program, and the green building program (Betsill 2001). While this does not include all aspects of sustainable development, it does significantly reduce the number of departments that need to be consulted.

Another large barrier to ICLEI adoption is the framing of climate change. Climate change has long been framed as a global issue that requires a global solution, and so many people are unable to see how one city can have any impact on it (Betsill 2001). This framing places the burden for mitigation at the national and international levels because that is where most of the discussion and debate has taken place. Cities that are more reliant on carbon emissions to fuel their economy might be more reluctant to commit to ICLEI. The economic costs of using less carbon will be greater for some cities than for others, and so they have less incentive to join (Zahran, Grover, Brody, &

Vedlitz 2008b). This leads cities that produce the least carbon emissions to reduce those emissions while the cities that emit the most are not, and so not enough overall emissions are being reduced. This debate has unfortunately turned into a bitter partisan issue, with politicians who endorsed climate action just a few years ago now being forced to recant those positions. This political meddling has hampered the public's ability to understand climate change and resulted in increasing polarization over the issue (Linstroth & Bell 2007).

The science of climate change is an extremely technical issue, and it takes time and effort for anyone, including city employees, to gain a thorough understanding of it. This knowledge gap can be a significant impediment for many cities, and can lead them to simply not bother with climate change as a policy issue. Many cities also do not understand how climate change affects them; they see it as a global issue that should be solved at the global level, and not as a problem that localities can deal with. Betsill (2001) concludes that the best way to get cities to implement greenhouse gas mitigation measures is by *not* talking about climate change. Instead, she encourages cities to "think locally, act locally," implying that thinking globally is not a good hook for many cities. By focusing on the co-benefits of mitigation, cities can still reap all of the local benefits without having to explicitly say that they are doing so because of climate change. This could be a very attractive option for some cities that face resistance to climate change mitigation. It does not add to a feeling that the city is somehow losing money or giving up quality of life for climate change purposes; instead it highlights the money-saving aspects and the enhanced liveability of the cities.

Some cities choose not to reduce their carbon emissions because they feel that the effort is pointless. Even if there was comprehensive climate change legislation, it would take years to go into effect and actually reduce emissions (Linstroth & Bell 2007). An emerging consensus among climate scientists is that it is already too late to avert climate change – even if emissions fell to zero

immediately, the built-up carbon in the atmosphere would still be present for decades (Hansen 2009). This might suggest that it is worthless to try and reduce emissions, but mitigation can still reduce the potential levels of greenhouse gases. If no action was taken, the amount of carbon would continue to grow without end, but action now can reduce the total amount of climate change. Cities can still have an effect on climate change, even if some of the consequences cannot be avoided.

2.2.3 Factors that Influence ICLEI Adoption

Cities that decide to make a climate action plan or join ICLEI have certain intrinsic factors in common. These cities have decided that despite the obstacles, it is worth it to them to work towards climate mitigation. Cities that join ICLEI have inherently different characteristics than the cities that choose not to join. These broad underlying traits include socioeconomic factors, political attitudes, perceived vulnerability to climate change, and internal city government structure.

Several socioeconomic factors that have consistently been found to be significant predictors are high population density, high education and income levels, voting Democratic, high levels of community activism, college-town status, proximity to other adopting cities, city ownership of local electric utilities, and the percentage of residents who recycle. (Boswell et al. 2010; Pitt 2010; Vasi 2006). These variables all account for the social and economic differences between cities, and so cities with higher social capacity and higher economic scores are more likely to be a member of either ICLEI or the MCPA. Many of these factors also correlate with cities that have a higher overall environmental awareness. Factors that have a negative association with climate change mitigation are the percentage of the population employed in carbon-related industries, the number of residents who drive alone to work, and the amount of hazardous air pollutant emissions per capita (Zahran et al. 2008a). Cities that score high on these factors rely on carbon emissions as an

economic engine more than other cities that may have less sprawl or more residents employed in the service sector, instead of manufacturing.

Within city governments, Bulkeley (2003) has identified five major factors that determine whether or not a local government will take action on climate change: a committed government individual; ample funding; local power over energy, transportation, and planning; the framing of climate change in relation to the economy; and the political will to act. Without this backbone of support, cities are unlikely to regulate their greenhouse gas emissions in a meaningful way. This can be tricky to measure, however, since many aspects are subjective. It is hard to measure a variable such as "political will to act" from a survey. This involves knowing very specific details about each city, so many studies simply use funding levels or the type of government a city has instead of looking at the less quantifiable variables.

Vasi (2006) found that how ICLEI is framed can have a large impact on the decision to join ICLEI. Cities that emphasized the co-benefits of climate mitigation planning, such as air quality and saving money through fuel efficiency, were more likely to join ICLEI. This study also found that locational proximity to cities that were already ICLEI members has a large influence on ICLEI adoption.

Vulnerability to natural disasters and sea-level rise has been found to have a moderately strong correlation with climate planning (Zahran et al. 2008b), although this factor alone is not always enough to prompt a city to join ICLEI (Zahran et al. 2008a). Zahran et al. have found that, overall, cities are more likely to join ICLEI if they score higher on the socioeconomic and civic capacity scales, and less likely if they have a large industrial sector. Specific factors such as recycling rates and the use of solar energy also had a high correlation with ICLEI involvement. They also found that the regions that cause the most climate change stress (regions that emit more CO_2 and

rely more on cars) are not the regions that are most at risk from sea level and temperature rises. In other words, most of the damage from climate change is emanating from regions that have the least to lose from climate change, and therefore they have much less incentive to reduce emissions voluntarily.

2.2.4 Factors that Influence ICLEI Commitment

While there has been a good amount of research that looks at what factors prompt a city to join a climate mitigation program, there are only a few studies that try to look at how those factors influence a city's actual commitment to reducing greenhouse gases. Many cities have signed on to the MCPA and ICLEI, but not nearly as many have climbed up the milestone ranking by achieving their emissions reduction goals. Pitt (2010) is one of the few researchers who has studied this issue. He found that local government and community environmental awareness, the presence of assigned staff members working on climate issues, and the influence of neighboring cities are the most important determinants of how well a city is implementing its climate goals. He also found that the conventional factors that influence whether or not a city has a plan, such as education level, voting history, income, and college town status, have little to no influence on a city's commitment to reducing climate change. This is a significant finding as it suggests that all of the previous research, which has focused on the simple yes/no question of whether a city is taking sustainability measures, is inadequate when it comes to measuring the commitment level of those same cities.

Krause (2011) measures commitment by creating a municipal climate-protection index. This index builds off of the previous studies of Portney (2003) and Lubell, Feiock, and Handy (2009) that measured commitment to overall sustainability. Krause's index uses greenhouse gas inventories, broad energy efficiency measures, and green development and transportation initiatives to measures a city's overall commitment to climate actions, regardless of whether these are explicit or

implicit climate policies. This can include cities that have not expressly joined an organization such as ICLEI or the MCPA, but that have introduced climate-friendly measures such as energy-saving policies or alternative transportation. The primary motivator for action for these cities does not need to be climate protection, but can be based on saving money or reducing congestion. The results of this study showed that the most committed cities had larger populations, a higher level of educational attainment, Democratic party leanings, and a climate policy entrepreneur within the local government. A higher median household income was associated with a lower commitment level, and the reliance on the manufacturing sector and the number of environmental organizations were found to have no significant effect. These last results differ from most of the research on the initial factors that motivate adoption of climate policies.

Sharp et al. (2011) conducted a study that looked at the factors that influence both ICLEI adoption and commitment to ICLEI. Their study used the ICLEI milestones to measure a city's commitment to ICLEI, but they only looked at ICLEI cities with over 100,000 residents. They used ten variables but did not include any measures of vulnerability. Their results showed that different factors influence joining ICLEI and commitment to ICLEI, and that the length of time as an ICLEI member had the strongest influence on commitment.

These results are sparse and inconclusive because climate commitment has not been studied as much as ICLEI involvement. Some of the factors are the same, but many important factors appear to be different when it comes to measuring a city's actual commitment. The purpose of this research is to add to this growing field by focusing solely on factors that influence a city's ICLEI milestone accomplishments.

CHAPTER 3: DATA AND METHODS

3.1 ICLEI Cities

ICLEI-USA currently has over 600 members. All localities that joined ICLEI after 2008 were excluded from this study, since cities that joined after that have not had sufficient time to meet any of the milestones. All of the counties were likewise excluded, as the focus of this study is on cities. Including counties would have changed the scale of the project, since cities and counties have different governing structures. Several of the ICLEI cities are also in counties that are ICLEI members, so including both would result in over counting of some areas. For the unit of analysis, previous researchers have used the Metropolitan Statistical Area (MSA), but for this study the city itself will be used as the unit of analysis. This may leave out some important effects of the city on the surrounding suburbs and vice versa, but since ICLEI is mainly signed by specific cities it makes sense within this study to focus only on the individual cities themselves, instead of the MSA. The purpose of this study is to find out what differences exist among specific cities, and using the whole region would water down the results because the suburbs of a city are often quite different from the city itself (Sharp et al. 2011).

Furthermore, all cities with populations under 20,000 were not included. The small size of these cities made it hard to collect accurate data, since they are often classified differently in different states, i.e. as townships or villages. This resulted in 257 cities being included in the study, all of which became ICLEI members prior to 2009 and had populations of at least 20,000. These cities are located in every state except Alabama, Delaware, Hawaii, Idaho, Mississippi, Nebraska, New Mexico, South Dakota, West Virginia, and Wyoming. These 10 states are not entirely outside of the ICLEI program, though. Many have had cities join since 2008, or the cities that had joined prior to that had less than 20,000 residents. Others, such as Hawaii, are represented by counties only

instead of cities and thus were not included in this survey. This leaves only two states that still have no ICLEI presence as of 2012, Mississippi and Wyoming.

ICLEI does not provide records of cities that have left the program. Several of these cities were still listed on the ICLEI member list in Spring 2011, but by Fall 2011 they had been removed. The 2010 Annual Report also included cities that were not listed on the website's member list, but there was no information on when these cities had joined and left ICLEI. Therefore, some of the cities in this study are no longer ICLEI members, and a few cities that used to be members are not included in the study due to a lack of information. Some cities may have left ICLEI at some point, especially once ICLEI started imposing membership dues in 2008. Regardless, even if a city has left ICLEI, the number of milestones it accomplished while in the program is still important.

3.2 Dependent Variable – ICLEI Milestones

The dependent variable is the number of milestones that a participating ICLEI city had achieved by Fall 2011. These milestone achievements are compiled from the ICLEI Member List and the 2010 Annual Report. Both reports were needed because some cities had left ICLEI after 2008 and were no longer on the website, but the 2010 report had information for all cities, past and present, that had achieved any milestones. The cities that had achieved zero milestones all came from the website member list, since the report did not highlight cities that had not attained any milestones. Milestone achievement can be for the city government operations only, the general community, or both. ICLEI does not always specify which cities measure the government or community emissions, so for this study it is impossible to differentiate between the two.

The milestones are the 5 goals that cities move through when they join ICLEI's CCP program. These milestones are:

1. Conduct an emissions inventory
2. Adopt an emissions reduction target

3. Develop a Local Climate Action Plan
4. Implement the Plan
5. Monitor and verify the results.

In a way, these milestones can be thought of as trying to find which cities are taking sustainability seriously. There are many dimensions of sustainability, and using the ICLEI milestones as a proxy for sustainability is one way of measuring this. It takes a conscious and dedicated effort to conduct a carbon emissions inventory, create a mitigation plan, and then follow through on that plan. Cities that accomplish more milestones see climate mitigation as an important goal for that city to pursue, and it can be inferred that these cities are more committed to climate change mitigation. The milestones are already divided into five levels of achievement, making it easier to see a linear path for commitment and allowing each city to be compared on the same scale.

3.3 Independent Variables

This study includes 15 dependent variables (Table 3.1). They can be divided into four groupings that are adapted from Zahran et al. (2008b): socioeconomic, climate change stress, local attitudes, and geographic location. Variables that look at the internal government structure of a city are not being used because it is difficult to gather this information without conducting a survey of city managers. The variables chosen represent a wide spectrum of factors that have been proven to be significant in prior studies.

Table 3.1 Independent Variables

Variable	**Variable Definition**	**Data Source**
Dependent Variable		
Milestones	The number of ICLEI milestones a city has completed (0-5)	ICLEI website (2011)
Socioeconomic		
Bachelor's degree	Percentage of city residents over age 25 who have a bachelor's degree or higher	2005-2009 American Community Survey

Poverty	Percentage of residents whose income for the last 12 months was below the poverty level	2005-2009 American Community Survey
Unemployment	Percentage of the civilian labor force that is unemployed	2005-2009 American Community Survey
Median income	Median household income	2005-2009 American Community Survey
Population	Total number of residents in a city	2005-2009 American Community Survey
White	Percentage of residents that marked white as their only race or ethnicity	2005-2009 American Community Survey
Climate Change Stress		
Carbon employment	Percentage of residents 16 years or older who are employed in carbon dioxide intensive industries	2005-2009 American Community Survey
HAP emissions	Total HAP emissions divided by the number of residents	EPA AirData website
Car dependency	Percentage of workers 16 years and older that commute to work alone in a car, van, or truck	2005-2009 American Community Survey
Population density	Total population divided by land area of the city	2005-2009 American Community Survey
Local Attitudes		
Environmental non-profits	Number of non-profits divided by the number of residents	National Center for Charitable Statistics (2011)
State initiatives	Number of state initiatives as measured by the Pew Center on Global Climate Change	Pew Center on Global Climate Change (2011)
Vote for Obama	The percentage of the county that a city is located in that voted for Obama in 2008	New York Times Election Results Map (2008)
Years in ICLEI	The number of years that a city has been an ICLEI member	ICLEI website (2011)
Geographic Location		
Coastal county	Dummy variable for whether or not a city is located in a county that is on the coast	Personal Data – examined county maps

3.3.1 Socioeconomic

Education levels, unemployment, median income, and the poverty rate are all standard socioeconomic characteristics that have been found to be significant in other studies. Zahran et al. (2008b) characterizes these variables, along with voting trends and environmental leanings, as "civic capacity" variables, and uses this to postulate that a higher civic capacity leads to higher sustainability levels. Higher levels of educational attainment, higher household income, low unemployment rates and low poverty levels are generally correlated with higher commitments to sustainability. There are numerous exceptions to this rule, but in reviewing the relevant literature at least one, educational attainment, is almost always a significant variable for ICLEI adoption.

The *% with bachelor's degree* variable is the percentage of the population over age 25 who have a bachelor's degree or higher. *% unemployed* is the percentage of the civilian labor force that is unemployed. *% poverty* is the percentage of people whose income for the last 12 months was below the poverty level. *Median income* is the median household income. *Population* is simply the total number of residents in a city. *% white* is the percentage that marked white as their only race or ethnicity. Race does not seem to have been used as a variable in other studies. This variable was used partly for that reason, because it could be a significant factor that had never been counted before. All of these variables were taken from the 2005-2009 American Community Survey 5-Year Estimates.

3.3.2 Climate Change Stress

Zahran et al. (2008b) classifies carbon-intensive industry, transportation patterns, energy use, and population density as climate change stress variables. These variables all relate to the impact, or stress, that a city places on its surrounding environment. Cities with a higher percentage of residents that are reliant on cars or employed in carbon industries are traditionally less likely to

join a climate mitigation plan because the economic losses of joining could be higher than for cities that are not as carbon-intensive.

% carbon employment measures the percentage of residents 16 years or older who are employed in carbon dioxide intensive industries such as construction, agriculture, mining, manufacturing, utilities, and transportation. This information was obtained from the 2005-2009 American Community Survey 5-Year Estimates. Hazardous Air Pollutant (HAP) emissions are useful data to consider because cities with poor air quality are likely to be more reliant on carbon-intensive industries, but they also have an incentive to reduce these pollutants in order to improve their air quality. ICLEI often packages climate change measures as air quality measures in order to attract more cities interested in health and environmental benefits (Vasi 2006). To measure *HAP emissions* the total amount of HAP emissions for each city were obtained from the EPA's AirData website. This amount was then divided by the number of residents of each city in order to compare emissions per capita between cities.

Car dependency is the percentage of workers 16 years and older that commute to work alone in a car, van, or truck. This variable is a way of looking at how easy it is to get around in a city, and whether or not a city has already made investments in public transportation, bikeability, and walkability. For instance, only 39.8% of San Franciscans commute alone, but 81.7% of those living in Akron, Ohio commute alone (data obtained from American Community Survey 2009). This variable alone gives a quick snapshot of cities that routinely encourage more sustainable forms of transportation. This can also correlate directly with carbon emissions and a city's overall level of sustainability, and the ease with which a city can transition from carbon intensive travel patterns to alternative forms of transport.

Population density data divides the total population of the city by the land area. The population density of cities is a good way of measuring the existing energy use levels and transportation patterns in a city, both of which have been found to be significant predictors of joining ICLEI (Zahran et al. 2008a). A compact, dense city does not need to expend as much energy per person as does a large, sprawling city that relies on the personal automobile as the main form of transportation. The data for this variable and *car dependency* came from the 2005-2009 American Community Survey 5-Year Estimates.

3.3.3 Local Attitudes

The general category of local attitudes is an attempt to capture the underlying environmental and political leanings of a city. "Green" leanings, recycling, and other measures of environmental protection were found to be significant variables in previous studies (Boswell 2010; Zahran 2008a). While Zahran et al. (2008b) placed some of these variables into the civic capacity category, for this study a separate category called "local attitudes" has been created because some of the variables represent the local attitudes but not necessarily the civic capacity.

The *environmental nonprofits* variable captures part of the environmental outlook of a city. Using this rationale, Seattle, with 100 environmental non-profits, should in general be seen as more environmentally friendly than El Paso, which has roughly the same population as Seattle but only 15 non-profits (data obtained from National Center for Charitable Statistics). From this, it can be posited that a city with more environmental non-profits should be more receptive to ICLEI's message. The environmental non-profit data was collected from the National Center for Charitable Statistics and then divided by the number of residents in a city to ease comparison across cities. The NCCS collects data on non-profits that are tax-exempt, have more than $25,000 in gross receipts, and are required to file Form 990 with the Internal Revenue Service. A potential shortfall of this

database is that it only collects information on non-profits that make over $25,000. In many smaller towns, it is likely that there are some nonprofits that make less than this, and are therefore not counted in this database. However, it is the only database on environmental non-profits that was easily available, and it has already been used as a reference by Zahran et al. (2008a).

While cities are not necessarily dependent on state-level climate mitigation actions, these actions can give a broad picture of the external factors that affect a city. Each city is nested within its state and the surrounding region, and it is possible that the trends that appear at the state level have some correspondence with city-level trends (Pitt 2010). To capture this *state initiatives* variable a table from the Pew Climate Center was used (http://www.c2es.org/docUploads/All-State-Initiatives.pdf). This table tallies up all state actions in the categories of climate action, energy sector, transportation, and the building sector. Within these categories are 28 separate initiatives that are available to states, including regional initiatives (Western Climate Initiative, Regional Greenhouse Gas Initiative, etc.), identifying greenhouse gas targets, renewable portfolio standards, low carbon fuel standards, green building standards, and many others. No state has completed all 28 actions, but four states (California, Connecticut, Oregon, and Vermont) have completed 26 of them. Each city therefore receives a score based on which state they are located in. For instance, each city is California is given a score of 26 since the state has 26 climate measures in place.

Political affiliation was measured by using the percentage of people that voted for Obama in the 2008 election, according to the New York Times Election Results Map. This map shows the election results by county, and that county number was used for each city within the county. Data that directly measured city results could not be found, so the county-level data was used instead. This *% vote for Obama* variable should give a rough estimate of Democratic voters at the time, and being a Democrat instead of a Republican is often positively correlated with increased

environmental awareness and action (Boswell et al. 2010). This method of measuring political affiliation has been used by other researchers (Zahran et al. 2008a) who used the 2004 presidential election county results to code MSA's as Democrat or Republican.

Years in ICLEI can also be considered a measure of local attitudes, since the frontrunner cities of the 1990's must have had some reason to join early instead of waiting until 2007 or 2008. This variable comes from the member list on ICLEI's website, and is measured as the number of years that a city has been an ICLEI member. The first cities to join ICLEI joined in 1991, and the last cities in this study joined in 2008, so this value ranges from 1 to 18.

3.3.4 Geographic Location

A few researchers have looked into how a city's geography might play a role in their climate mitigation actions. This is often framed through the lens of vulnerability, with certain geographic features presumed to increase or decrease a city's vulnerability to climate change. Zahran et al. (2008a) conducted an analysis that included socioeconomic conditions as well as vulnerability to climate change to study local commitment to climate policy. That study used location in a coastal county, the number of extreme weather events, and expected temperature change due to climate change to assess a community's vulnerability. All three of these variables were found to be significant predictors of climate action. While these factors undoubtedly have a role in the cities that will be analyzed, for this study only the coastal county variable will be used. Vulnerability is very difficult to accurately measure, and while Zahran et al. (2008a; 2008b) found a good number of variables that represent certain aspects of vulnerability, they do not adequately capture the entire factor of vulnerability. Additionally, many of these differing aspects of vulnerability may not be well understood by city planners and officials. For instance, it is widely understood that climate change will raise sea levels, thereby threatening coastal cities, but it is less understood and known how

exactly temperature or rainfall patterns will alter in a specific region (United Nations Environment Programme 2010). These factors require more specialized knowledge to fully understand, but coastal erosion and land loss often seem more immediate and can have a more visible impact on communities.

For the *coastal county* variable, a dummy variable was used that measured whether or not a city was located in a county directly adjacent to the coast. This was done by looking at county maps for each state and determining which counties were directly on the ocean. This measurement of course misses many low-lying cities that are not directly on the coast, such as Philadelphia, but they are the best measurements that could be found. NOAA's coastal counties list (http://www.census.gov/geo/landview/lv6help/ coastal_cty.pdf) includes numerous counties that are part of the coastal watershed but not directly on the coast, which includes almost the entire state of Michigan. This measurement seemed too broad to show which counties were physically on the coast. This variable is more a measure of location than of vulnerability, as coastal location does not automatically mean that a city is more vulnerable. Since this was a dichotomous variable it was not suitable for inclusion in the regression model, but a separate chi-square test was run to test the differences in commitment levels by coastal and non-coastal cities.

3.4 Methods

This analysis was conducted using multiple regression, a chi-square test, and principal component analysis. PCA is used to reduce the initial number of independent variables by searching for the common underlying factors. The resulting principal components capture as much of the variation in the initial data set as possible while reducing the number of variables that need to be examined (Mertler & Vannatta 2005). For this study, PCA will help clarify the common factors that underlie the independent variables and show how the variables group together, and if those

groupings are different than the conventional categories that they have been placed into. If they are different, it could shed light on how different cities respond to ICLEI's climate mitigation campaign. The simplification of the variables could allow one of the factors to emerge as more significant than it was when fifteen separate variables were used.

The Chi-square test is used to test whether two categorical variables are associated with each other (Key 1997). For this study, it was used as a rough measure of whether or not there is a significant difference in milestone accomplishment between the coastal and non-coastal cities. Due to the dichotomous nature of the variable the results will not be as exact as they are for a regression analysis, but it will still provide information on the general effect or non-effect of being located in a coastal county. Using this test allows the effects of perceived vulnerability to climate change to be studied.

Multiple regression was used to determine which of the fourteen variables have the largest effect on ICLEI commitment. Regression is often used to explain causal relationships among variables and the effect that the independent variables have on the dependent variable. This statistical test has been used in some of the related literature, but each one reached different results as to which variables were the most influential. Each study has also used different independent variables, which leads to different results. Only one previous study has used ICLEI's five milestones as the dependent variable, so this research will be useful in furthering the study of ICLEI commitment as measured by ICLEI's own scoring system.

CHAPTER 4: RESULTS

4.1 Exploratory Analysis

Figure 4.1 shows the spatial location of the 257 cities that are a part of this study. This map shows that there is a clustering of cities around Puget Sound, in California, and in the DC-New York City-Boston corridor. The Bay Area of California appears to have the highest concentration of ICLEI cities, while some areas of the Midwest have no ICLEI cities at all. The spatial distribution indicates that ICLEI has a broad overall presence. The Great Lakes States, the upper South, and several mountain states all have several ICLEI cities. Not all of these states are traditionally thought of as being interested in sustainability (Rabe 2010; Sharp et al. 2011), so this attests to the extensive reach of ICLEI's programs.

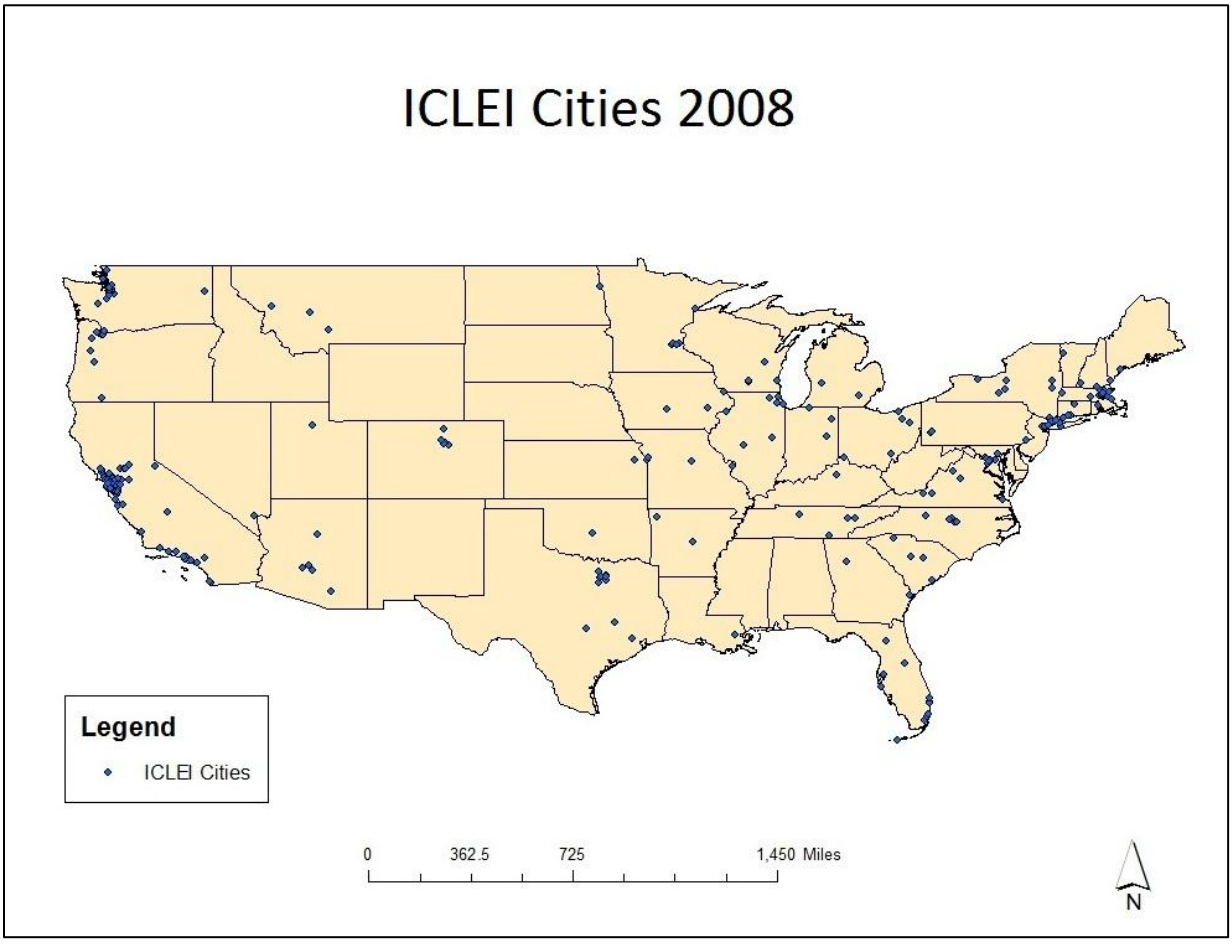

Figure 4.1 ICLEI Cities

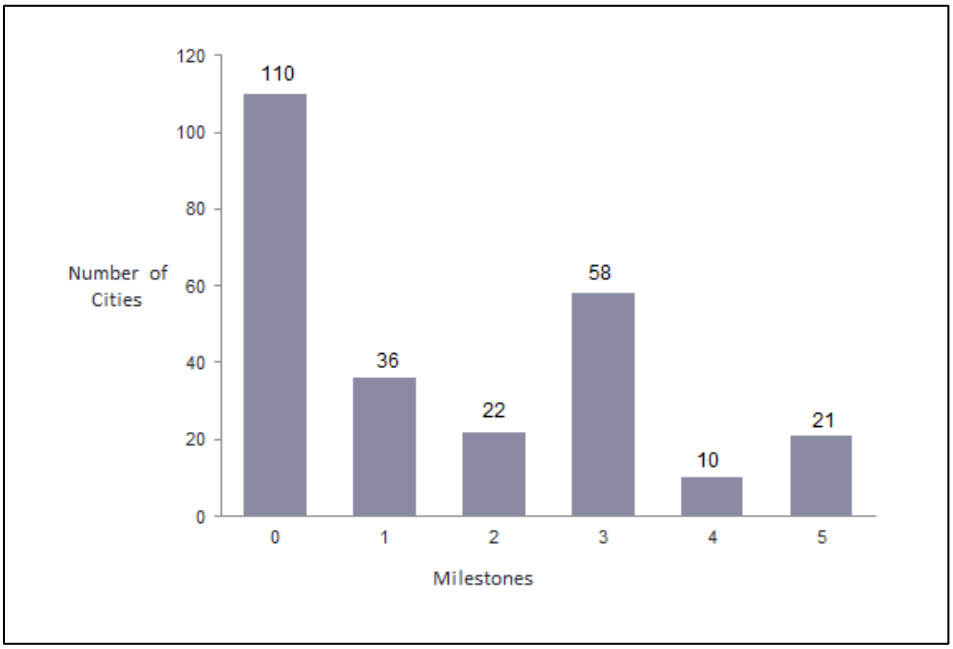

Figure 4.2 Milestone Completion

Figure 4.2 provides a quick snapshot of how many cities are in each milestone category. The majority of the cities in ICLEI have completed 0 or only 1 milestone. Only 31 out of a total of 257 cities have reached milestones 4 and 5, which gives an initial picture of the difficulty in completing all of the milestones. Fifty-eight cities have reached Milestone 3, which is unusual given the low numbers on both sides of it. Milestone 3 is to "Develop a Local Climate Action Plan," so it could be that many cities are able to reach this stage but then have trouble with the actual implementation of the plan. The cities that have reached milestones 4 and 5 are displayed in Table 4.1. These cities have the highest levels of commitment to ICLEI. The Milestone 5 cities are generally larger cities that have a "green" reputation, such as San Francisco, Portland, and Seattle. The ten cities that have reached milestone 4 are somewhat smaller cities that are not as generally well-known, but they still have "green" reputations. Many of these cities are the same cities that rank the highest on Portney's (2011) sustainability ranking. This table suggests that, for the most part, the cities that are

the most committed to ICLEI are the same cities that are well-known for being committed to other sustainability and environmental initiatives.

Table 4.1 Highly Committed Cities

Milestone 5	Milestone 4
Berkeley, CA	San Diego, CA
Chula Vista, CA	San Jose, CA
San Francisco, CA	San Rafael, CA
Santa Monica, CA	Stamford, CT
Boulder, CO	Medford, MA
Denver, CO	Ann Arbor, MI
Fort Collins, CO	Keene, NH
Boston, MA	Hamilton, NJ
Cambridge, MA	Salt Lake City, UT
Minneapolis, MN	Bellingham, WA
Saint Paul, MN	
Asheville, NC	
Durham, NC	
New York City, NY	
Portland, OR	
Pittsburgh, PA	
Austin, TX	
Burlington, VT	
Seattle, WA	
Olympia, WA	
Madison, WI	

The descriptive statistics (Table 4.2) contain some illuminating insights about the cities that are ICLEI members, regardless of how many milestones they have achieved. Cities that choose to join obviously have some characteristics in common that would prompt them to make some sort of commitment to ICLEI. The mean of *% bachelor's degree* was 40% and the median income was $62,960, showing that cities that join ICLEI have a fairly educated and wealthy populace. Additionally, 62% voted for Obama in 2008 and only 19.5% were employed in the carbon industry, showing a preference for cities that vote Democratic and are employed in non-carbon industries

such as education, government, or the service industry. In terms of population, it can be inferred that somewhat larger cities with a moderately high population density are prompted to join ICLEI. The mean population was 201,837 residents and the mean population density was 3,916 per square mile.

Table 4.2 Descriptive Statistics

	Mean	Std. Deviation
milestones	1.55	1.667
population	201837.77	595887.174
% bachelor's	40.840	16.0112
% unemployed	6.939	2.2371
% car dependency	71.446	10.4557
median income	62960.60	26344.223
% poverty	13.755	8.6797
% vote obama	62.569	10.6390
% white	70.911	16.6333
% carbon employment	19.542	6.0528
HAP emissions	300.4120	472.85682
enviro nonprofits	.9474	1.18479
population density	3916.7564	2991.66734
state initiatives	21.3424	5.23803
years in ICLEI	15.8171	3.87420

4.2 Principal Component Analysis

The first part of the analysis involved a Principal Component Analysis to determine if the variables could be separated into influential underlying components. The KMO measure of sampling adequacy was .663, which is in the acceptable range of rating scores as described by Fields (2005). According to this scale, a score of 6 is "mediocre" and a score of 7 is "middling", so the score is acceptable for the purposes of this study. The Bartlett's test of sphericity was .000, showing that the correlation matrix is not an identity matrix.

PCA was run to only include components that had an eigenvalue greater than 1. The mean communality of the variables was also greater than .60, and when combined with an sample size greater than 250 this validates the rule of only using components with eigenvalues greater than 1 (Stevens 1992). These selection criteria resulted in four components being selected. An examination of the scree plot and eigenvalues confirms that only four components need to be retained, since the scree plot levels off after the first four and the fifth component only has an eigenvalue of .852. The total variance explained shows that the four components together account for 68% of the explained variance (Table 4.3).

Table 4.3 PCA Results for Total Explained Variance

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.547	25.333	25.333	3.547	25.333	25.333	3.288	23.488	23.488
2	2.706	19.328	44.661	2.706	19.328	44.661	2.324	16.602	40.091
3	2.251	16.081	60.742	2.251	16.081	60.742	1.995	14.248	54.339
4	1.026	7.328	68.071	1.026	7.328	68.071	1.922	13.732	68.071

Extraction Method: Principal Component Analysis.

The rotation method used was varimax orthogonal. This is generally recommended as the best form of rotation to use, since it assumes that the factors are uncorrelated with each other and can better show the underlying components (Mertler & Vannatta 2005). Before rotation, the first component alone explained 25.33% of the variance. These numbers change slightly after rotation, with the values for components 1, 2, and 3 being reduced and component 4 accounting for a much larger percentage of the variance. Overall, the variance is spread fairly evenly among the four components, with no component accounting for less than 13% of the variance.

Table 4.4 PCA Results for Rotated Component Matrix

Rotated Component Matrix(a)				
	Component			
	1	2	3	4
population	-.087	-.159	-.050	**.889**
% bachelor's	**.629**	**.635**	-.027	.036
% unemployed	**-.797**	-.260	.266	.074
% car dependency	.185	**-.566**	-.460	-.499
median income	**.900**	-.023	.146	-.074
% poverty	**-.856**	.279	-.045	.110
% vote obama	.129	.144	**.798**	.139
% white	.343	.386	**-.598**	-.196
% carbon employment	-.108	**-.832**	.069	-.136
HAP emissions	.537	-.047	.243	-.164
enviro nonprofits	-.202	**.690**	.003	-.153
population density	-.049	-.047	.514	**.701**
state initiatives	.413	-.056	**.594**	-.013
years in ICLEI	.157	.290	-.106	-.490
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a Rotation converged in 8 iterations.				

The rotated component matrix shows which variables can be sorted into the same components (Table 4.4). Component 1 consists of *% bachelor's degree* (.629), *% unemployed* (-.797), *median income* (.900), *% poverty* (-.856), and *HAP emissions* (.537). These variables mostly measure some aspect of the socioeconomic characteristics of each city, and show that poverty and unemployment have a negative correlation with income. This component can be labeled as "socioeconomics". *HAP emissions* is the only variable that loads unexpectedly onto this component. *HAP emissions* also loads on a different component from the other "climate stress" variables, suggesting that the total amount of emissions produced is different from the overall reliance of a city on carbon-based industries.

Component 2 includes *% bachelor's degree* (.635), *% car dependency* (-.566), *% carbon employment* (-.832) and *environmental non-profits* (.690). All of these variables except for *% bachelor's degree* fit into Zahran's et al.'s climate stress categorization, and so this factor can be labeled "climate stress". The number of non-profits has a negative correlation with car dependency and carbon employment, suggesting that cities that are more reliant on carbon-based transportation and industry have fewer environmental non-profits. *% bachelor's degree* loads almost equally on both this component and Component 1. It makes sense that it would be categorized with the other socioeconomic variables on Component 1, but it is interesting that it loads with Component 2 as well. This result shows that a higher percentage of bachelor's degrees correlates negatively with both car dependency and carbon employment, and therefore more highly-educated cities could have less "climate stress" overall, and more environmental non-profits.

Component 3 consisted of *% white* (-.598), *% vote for Obama* (.798), and *state initiatives* (.594). Since *% white* and *% vote for Obama* do not have high loadings on any of the other components, it can be inferred that there is some correlation between the two variables. This correlation appears to be negative, which is a completely unexpected result. This is not particularly relevant for a climate change study, but it could be useful in other avenues of social and political science research. The number of state initiatives has a somewhat positive relationship with voting for Obama, which lends support to previous studies showing that more Democratic states have more climate change and environmental initiatives (Boswell 2010). This component does not have a unifying theme, although it could be loosely thought of as stemming from voting trends and local attitudes.

The fourth component includes *population* (.889) and *population density* (.701). Both variables have a positive loading, so a higher population correlates with higher population density.

These variables can be grouped under the label of “demographics”, since they both measure something about the population characteristics.

The only variable that does not load onto any of the four components is *years in ICLEI*, suggesting that it does not have strong correlations with any of the other independent variables. This is also visible in the Pearson correlations table (Appendix B), where the only significant correlation for *years in ICLEI* is with the dependent variable of milestones. For the most part the rest of the variables sorted into the pre-defined categories of socioeconomics, climate stress, and local attitudes. A notable exception was *HAP emissions*, which did not load on the same component as two of the other climate stress variables, *car dependency* and *% carbon employment*.

4.3 Chi-Square Test

The chi-square results show a Pearson’s value of 4.273 with a significance of .511 (Table 4.5). Based on this, the null hypothesis cannot be rejected, and there is therefore no difference in milestone completion between coastal and non-coastal cities.

Table 4.5 Chi-Square Results

Chi-Square Tests			
	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	4.273(a)	5	.511
Likelihood Ratio	4.271	5	.511
Linear-by-Linear Association	1.480	1	.224
N of Valid Cases	257		
a 1 cells (8.3%) have expected count less than 5. The minimum expected count is 4.09.			

This is a somewhat unexpected result, since Zahran et al. have multiple studies that showcase the importance of vulnerability and geographic location in predicting ICLEI adoption (2008a; 2008b). Their study was one of the first studies that showed that coastal proximity was an important factor in influencing ICLEI adoption. This could be another aspect of the divergence

between ICLEI adoption and ICLEI commitment. Coastal proximity might prompt a city to join ICLEI, but it has no effect on a city's commitment over time. The difficulty in measuring coastal location could also play a role in these differing results. One of Zahran et al.'s studies used a dichotomous coastal county variable as the measurement, while the other used the percentage of city land area that was at or below 3.5 meters above sea level. These different ways of measuring could lead to different results.

4.4 Multiple Regression Analysis

Prior to conducting the multiple regression analysis, the variables were screened for multicollinearity (Appendix B). The only variables that exhibited any significant collinearity were *% poverty* and *median income*, which correlated at -.808, but this correlation was not high enough to justify its removal from the analysis. There was a slight correlation between *% unemployed* and *% bachelor's* degree at -.602, and between *median income* and *% bachelor's degree* at .613. Both of these results were significant at the .000 level. These numbers both indicate that having at least a bachelor's degree is somewhat correlated with a lower unemployment rate and a higher median income. The tolerance statistics indicate that, overall, multicollinearity among the independent variables is not a problem, since all of the values are above .1.

The multiple regression analysis yielded an adjusted R square value of .316, meaning that this model accounts for almost 32% of the variance of the dependent variable, the number of milestones achieved. The ANOVA table confirms that this result is significant, with an F-statistic of 40.47 and a significance level of .000. Using the stepwise method, three variables were entered into the model in order of significance to the model: *years in ICLEI*, *HAP emissions*, and *car dependency* (Table 4.6). The adjusted R square of the first model iteration was .275, with the year that a city

joined ICLEI having the most impact on this model. The other two variables contributed somewhat, but *years in ICLEI* is the strongest predictor of a city's commitment to ICLEI.

Table 4.6 Regression Results

Model Summary(d)										
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Change Statistics**					**Durbin-Watson**
					Sig. F Change	**R Square Change**	**F Change**	**df1**	**df2**	
1	.527(a)	.278	.275	1.419	.278	98.253	1	255	.000	
2	.556(b)	.309	.303	1.392	.030	11.203	1	254	.001	
3	.569(c)	.324	.316	1.379	.016	5.853	1	253	.016	1.768
a Predictors: (Constant), years in ICLEI										
b Predictors: (Constant), years in ICLEI, HAP emissions										
c Predictors: (Constant), years in ICLEI, HAP emissions, % car dependency										
d Dependent Variable: milestones										

The coefficients table shows the standardized coefficients of the three significant variables. The variable that has the most impact is *years in ICLEI*, with a beta value of .460, followed by *HAP emissions* at -.163 and *car dependency* at -.134 (Table 4.7).

Table 4.7 Regression Coefficients

Coefficients (a)						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
3	**(Constant)**	2.620	.662		3.958	.000
	Years in ICLEI	.198	.024	**.460**	8.325	.000
	HAP emissions	-.001	.000	**-.163**	-3.109	.002
	% car dependency	-.021	.009	**-.134**	-2.419	.016
a Dependent Variable: milestones						

The two supporting variables, *HAP emissions* and *car dependency*, are both climate stress variables. This suggests that commitment to ICLEI is strongly influenced by a city's perceived contribution to climate change. It is unclear if this is because the city officials understand their climate stress impacts and choose not to act decisively, or if it is because since they are reliant on

CO_2 emissions, they have less favorable environmental outlooks. This corresponds with the results of Sharp et al.'s study (2011), which found that the strong presence of industrial interests in a city led to lower ICLEI commitment. These climate stress factors are different than the dominant socioeconomic factors that have been found to predict ICLEI adoption. Zahran et al. (2008a) is one of the few studies that has found HAP emissions, coastal vulnerability, and car dependency to be strong predictors of ICLEI membership, but their studies did not look specifically at climate commitment. The results from this regression model are the first time that car dependency has been a significant variable in a commitment study. The negative beta value suggests that a city whose residents are more reliant on personal vehicles as the main mode of transportation has more difficulty fully committing to the ICLEI program. This is a useful finding for ICLEI if it wants to target cities with lower car usage levels for membership. This also highlights the importance of transportation patterns in general, and could be a fruitful avenue of research for cities that want to reduce their carbon emissions yet have high levels of car dependency.

The most important variable in this model is *years in ICLEI* –without this variable the regression results explain only a very small percentage of the variance. This result shows that cities that have been an ICLEI member longer have completed more milestones than the cities that have joined more recently. This is not a surprising result, since a city that joined in the 1990's has had more time to complete more milestones, unlike the cities that joined in 2007 or 2008. There are some cities that joined later that have completed an impressive number of milestones, such as Bellingham, WA, which joined in 2007 and had already completed four milestones by the end of 2008. However, these types of high-achieving cities are the exception. This result is the same as what Sharp et al. (2011) found in their study of ICLEI cities with more than 100,000 residents.

These results of this regression analysis differ significantly from that of Krause (2011). That study focused on a city's overall commitment to sustainability, and found education and voting history to be important factors, that higher income had a negative correlation with sustainability, and that climate stress variables had no impact. It is surprising that her study and this study had such different results, but it could point to a gap between the ICLEI program and overall sustainability. One drawback to ICLEI's milestones is that not all of the climate action plans are equal – there is no set rule as to which aspects of sustainability these plans should cover. Krause's index uses multiple indicators of sustainability, including green energy and transportation. It is possible that these cities have different underlying characteristics from the ICLEI cities, and so one group may not be as committed as the other group. The reasons for pursuing overall sustainability or committing to ICLEI seem to rely on different factors, further complicating climate change mitigation measurement.

These results confirm some of Pitt's (2010) results, in that factors that are important in ICLEI adoption are not nearly as important for measuring commitment to ICLEI. He found that socioeconomic factors had very little impact on commitment, and that environmental attitudes and practices were more important. The results of this study fall somewhat into line with that finding, since *car dependency* and *HAP emissions* are an offshoot of the overall environmental attitudes of an area. This information will be especially useful for future studies, as the researcher can focus exclusively on non-socioeconomic variables.

CHAPTER 5: CONCLUSION

The results of this study confirm and expand upon some of the previous research on ICLEI adoption and commitment. The majority of the previous studies that looked at ICLEI focused on the factors that influence a city's decision to join ICLEI, and not on their commitment once they were in the program. Of the studies that did investigate ICLEI commitment, only one used the five milestones as a proxy for commitment (Sharp et al. 2011). Using the milestones allows all of the cities to be measured by the same baseline and allows for a relatively easy comparison between the cities. The fifteen variables that were used cover many of the key aspects of Zahran et al.'s (2008b) categories: civic capacity, climate stress, and geographic location, along with a grouping of variables that cover local attitudes. All of these variables have been either known to or hypothesized to affect a city's commitment to climate change mitigation and ICLEI.

This study used principal component analysis, a chi-square test, and a multiple regression analysis to look at the influence different variables may have on a city's commitment to ICLEI. The findings from the PCA showed that the first four components accounted for almost 70% of the variance and that *years in ICLEI* is a unique variable that is not easily categorized. It was the only variable that did not load onto any of the four components. The other variables generally sorted into the expected components of socioeconomics, climate stress, and local attitudes, although there was some small variation in these results. *HAP emissions* sorted onto a separate component than the other climate stress variables, suggesting that climate stress is a difficult category when it comes to correlations and predictions. The chi-square results showed that location in a coastal county does not have an effect on milestone completion. This is a somewhat surprising result, since cities that are located on the coast face a higher risk from sea-level rise due to climate change. The regression results produced three variables that were the most influential in predicting ICLEI

commitment, *years in ICLEI, car dependency,* and *HAP emissions. Years in* ICLEI has a positive effect on milestone completion, while the other two variables have a negative effect, suggesting that a higher level of climate stress hinders a city's ability to fully commit to ICLEI.

The results of these analyses show that the factors that influence ICLEI adoption are very different from the factors that influence ICLEI commitment. Whereas socioeconomic and civic capacity variables are the most important predictors of adoption (Pitt 2010; Zahran et al. 2008a), climate stress and local attitude variables are more important for predicting commitment. This suggests that the two areas of research should be considered separately, and that looking at adoption alone does not have any bearing on commitment levels.

While this study included socioeconomic, local attitudes, climate stress, and locational variables, it did not include any variables that looked at the internal government characteristics of a city. A detailed survey would have been needed to assess the governance structure of each city. The form of government, i.e. mayor-council or council-manager, the level of funding devoted to environmental projects, and the presence of a policy entrepreneur are all aspects of a city's ability that cannot be gleaned from census data (Bulkeley 2003). It could be that these variables are the most influential in predicting local commitment to ICLEI, but the scope and timeframe of this study did not allow them to be examined. Additionally, it is likely that many cities would not have fully completed such a survey, which would have reduced the sample size. High-achieving cities might also have responded at a higher rate, skewing the results. However, these missing potential variables are an important aspect of sustainability that needs to be addressed in future studies.

A potential shortcoming of using the milestones to measure commitment to ICLEI is that the content of the climate action plans is not being evaluated. A city may have reached all five milestones by drafting a climate action plan and implementing it, but it is difficult to determine how

rigorous those plans are. Two cities that have both completed five milestones may have drastically different effects on greenhouse gas emissions, depending on what actions are included in their plan. ICLEI's milestones provide a useful framework for an initial study such as this one, but a more thorough content analysis will be needed to ascertain the actual effectiveness of those plans.

Based on the results of this study, future research could drop most of the socioeconomic variables from the analysis and focus more closely on the climate stress and local attitudes factors. Two of the three significant variables in the regression analysis fell into the climate stress category, and *years in ICLEI* is a measure of local attitudes. Therefore, future studies could eliminate some of the extraneous variables and gain a more concise picture of the factors that most influence ICLEI commitment. It might be useful as well to include aspects of vulnerability such as expected precipitation changes or temperature changes, both of which were significant predictors of ICLEI adoption in Zahran et al.'s research (2008a). Coastal proximity could also be reexamined as a possible measure of vulnerability. This variable did not have an effect on ICLEI commitment in this analysis, but it is possible that if it were measured in a different way and included in a regression model it might have an effect.

Cities that are committed to ICLEI can have a marked impact on climate change, especially as the number of cities that join the organization increases. The combined efforts of many cities could potentially result in large reductions of CO_2 levels because cities have the capability to implement new or untraditional projects for greenhouse gas mitigation (Lutsey & Sperling 2008). They are also directly and indirectly responsible for a large portion of the nation-wide emissions (Betsill 2000). The cumulative efforts of cities that are working under the ICLEI umbrella allows for a substantial reduction in emissions without needing to go through the political battles that a national or international plan usually entails. Cities that are part of ICLEI also do not have to frame

their efforts as primarily stemming from climate concerns. They can promote the economic, health, and quality of life benefits instead, potentially bringing in more support from people who would be turned off by an explicit "climate change" framing. Cities alone cannot solve all of the contributing factors of climate change, but they can prompt the international community to take action. The power of localities committing to mitigation is not that they will be able to completely reverse climate change, but that they can start a dialogue and hopefully prompt larger entities to search for a solution (Rabe 2004).

The inevitability of climate change also brings up the need for adaptation measures (Hansen 2009). This study did not look at adaptation, but cities need to start thinking about this as well as mitigation. Cities that are vulnerable need to start looking at what they can do to adapt. Cities that do nothing, either to mitigate or to adapt, will be paying more and suffering more in the future than the cities that did act (ICLEI USA 2012). Discussing adaptation needs to become as prevalent as discussing mitigation. Some of the effects of climate change, like increased or decreased precipitation, are not as well understood or even visible in the public eye. Cities may become extremely vulnerable to these events, yet they are completely unaware that this is even an issue they should be studying. Without some knowledge of these effects, it is impossible for those cities to adapt. ICLEI does have an adaptation program in place, but as the chi-square results from this study show, even the most at-risk cities are not making enough of an effort to tackle climate change.

Ultimately, climate change cannot be stopped without global action. This does not necessarily mean a global governance system such as the Kyoto Protocol. ICLEI is a worldwide organization, and it demonstrates how the local level can influence the global level. The regression results from this study accounted for only 32% of the variance, so there are still untested variables that could shed light on what makes a city an effective ICLEI participant. While it is difficult to get

cities to fully commit to ICLEI, there are still numerous cities that are making progress. Thirty-one cities have reached milestones 4 or 5, and fifty-eight have finished milestone 3. Despite all of the obstacles, these cities have been able to make some progress in reducing their carbon impact. The power of ICLEI lies in its ability to bring cities all across the world together in committing to climate change mitigation without needing to wait for a global agreement. More cities joining ICLEI and completing the five milestones can have a measurable impact on global emissions, because if local actions are part of the problem, it stands to reason that they can also be a part of the solution.

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APPENDIX A: FULL CITY LIST

City	State	Milestones	Year
Berkeley	CA	5	1991
Santa Monica	CA	5	1991
Portland	OR	5	1991
Olympia	WA	5	1991
Denver	CO	5	1992
Minneapolis	MN	5	1992
Saint Paul	MN	5	1992
Austin	TX	5	1993
Chula Vista	CA	5	1994
Boulder	CO	5	1995
San Francisco	CA	5	1997
Burlington	VT	5	1997
Cambridge	MA	5	1999
New York City	NY	5	1999
Seattle	WA	5	1999
Fort Collins	CO	5	2000
Boston	MA	5	2000
Madison	WI	5	2002
Durham	NC	5	2003
Asheville	NC	5	2006
Pittsburgh	PA	5	2007
San Diego	CA	4	2000
Ann Arbor	MI	4	2001
San Rafael	CA	4	2005
Medford	MA	4	2005
Hamilton	NJ	4	2006
Salt Lake City	UT	4	2006

City	State	Milestones	Year
San Jose	CA	4	2007
Stamford	CT	4	2007
Keene	NH	4	2007
Bellingham	WA	4	2007
Chicago	IL	3	1993
Atlanta	GA	3	1996
Santa Rosa	CA	3	2002
Rohnert Park	CA	3	2003
Windsor	CA	3	2003
Alameda	CA	3	2006
Palo Alto	CA	3	2006
Sacramento	CA	3	2006
San Leandro	CA	3	2006
Gainesville	FL	3	2006
New Orleans	LA	3	2006
Belmont	MA	3	2006
Worcester	MA	3	2006
Portland	ME	3	2006
Kansas City	MO	3	2006
Maplewood	NJ	3	2006
Babylon	NY	3	2006
Eugene	OR	3	2006
Charleston	SC	3	2006
Chattanooga	TN	3	2006
Houston	TX	3	2006
Kirkland	WA	3	2006
Tacoma	WA	3	2006

City	State	Milestones	Year
Phoenix	AZ	3	2007
Benicia	CA	3	2007
Dublin	CA	3	2007
Hayward	CA	3	2007
Martinez	CA	3	2007
Newark	CA	3	2007
Novato	CA	3	2007
Oakland	CA	3	2007
San Carlos	CA	3	2007
San Ramon	CA	3	2007
Key West	FL	3	2007
Miami	FL	3	2007
Newton	MA	3	2007
Northampton	MA	3	2007
Bozeman	MT	3	2007
Missoula	MT	3	2007
Winston-Salem	NC	3	2007
Nashua	NH	3	2007
Las Vegas	NV	3	2007
Brighton	NY	3	2007
Ithaca	NY	3	2007
Haverford	PA	3	2007
Philadelphia	PA	3	2007
Knoxville	TN	3	2007
East Palo Alto	CA	3	2008
Union City	CA	3	2008
Bridgeport	CT	3	2008
New Haven	CT	3	2008
Boynton Beach	FL	3	2008
Dedham	MA	3	2008
Grand Rapids	MI	3	2008
McMinnville	OR	3	2008
Nashville	TN	3	2008
Oak Ridge	TN	3	2008
Grapevine	TX	3	2008
Tucson	AZ	2	1993
Santa Cruz	CA	2	2001
Dallas	TX	2	2006
Roanoke	VA	2	2006
Spokane	WA	2	2006
El Cerrito	CA	2	2007
Fremont	CA	2	2007
Pittsburg	CA	2	2007
Richmond	CA	2	2007
Walnut Creek	CA	2	2007
Baltimore	MD	2	2007
Columbia	MO	2	2007
Cincinnati	OH	2	2007
Blacksburg	VA	2	2007
Charlottesville	VA	2	2007
Bellevue	WA	2	2007
Edmonds	WA	2	2007
Fitchburg	WI	2	2007
Flagstaff	AZ	2	2008

City	State	Milestones	Year
San Luis Obispo	CA	2	2008
Akron	OH	2	2008
Alexandria	VA	2	2008
Newark	NJ	1	1991
Duluth	MN	1	2001
Chapel Hill	NC	1	2001
Fort Wayne	IN	1	2005
Providence	RI	1	2006
Juneau	AK	1	2007
Danville	CA	1	2007
Lafayette	CA	1	2007
Menlo Park	CA	1	2007
Arvada	CO	1	2007
North Miami	FL	1	2007
Sarasota	FL	1	2007
Dubuque	IA	1	2007
Natick	MA	1	2007
Raleigh	NC	1	2007
Portsmouth	NH	1	2007
Huntington	NY	1	2007
Lake Oswego	OR	1	2007
Arlington	TX	1	2007
Everett	WA	1	2007
North Little Rock	AR	1	2008
Chandler	AZ	1	2008
Monterey	CA	1	2008
Napa	CA	1	2008

City	State	Milestones	Year
Oakley	CA	1	2008
Salinas	CA	1	2008
Branford	CT	1	2008
Washington, DC	DC	1	2008
Iowa City	IA	1	2008
Rock Island	IL	1	2008
Frankfort	KY	1	2008
Hingham	MA	1	2008
Lowell	MA	1	2008
Marshfield	MA	1	2008
Grand Forks	ND	1	2008
Syracuse	NY	1	2008
Muncie	IN	0	1991
Irvine	CA	0	2001
College Park	MD	0	2003
Denton	TX	0	2005
Santa Barbara	CA	0	2006
Des Moines	IA	0	2006
Pittsfield	MA	0	2006
Reading	MA	0	2006
Winchester	MA	0	2006
Roseville	MN	0	2006
Saint Louis	MO	0	2006
Saratoga Springs	NY	0	2006
Columbia	SC	0	2006
Plano	TX	0	2006
Harrisonburg	VA	0	2006

City	State	Milestones	Year
Oak Harbor	WA	0	2006
Milwaukee	WI	0	2006
Fayetteville	AR	0	2007
Antioch	CA	0	2007
Davis	CA	0	2007
Livermore	CA	0	2007
Manhattan Beach	CA	0	2007
Millbrae	CA	0	2007
Riverside	CA	0	2007
Santa Clara	CA	0	2007
West Sacramento	CA	0	2007
Windsor	CT	0	2007
Orlando	FL	0	2007
Tampa	FL	0	2007
West Palm Beach	FL	0	2007
Elmhurst	IL	0	2007
Northbrook	IL	0	2007
Lawrence	KS	0	2007
Lexington	MA	0	2007
Waltham	MA	0	2007
Gaithersburg	MD	0	2007
Rockville	MD	0	2007
Edina	MN	0	2007
Charlotte	NC	0	2007
West Windsor	NJ	0	2007
Albany	NY	0	2007
Clarkstown	NY	0	2007

City	State	Milestones	Year
Greenburgh	NY	0	2007
Mamaroneck	NY	0	2007
Yonkers	NY	0	2007
Alliance	OH	0	2007
Athens	OH	0	2007
Cleveland	OH	0	2007
Norman	OK	0	2007
Ashland	OR	0	2007
Hillsboro	OR	0	2007
Yardley	PA	0	2007
Radnor	PA	0	2007
Sumter	SC	0	2007
Norfolk	VA	0	2007
Issaquah	WA	0	2007
Lynnwood	WA	0	2007
Mercer Island	WA	0	2007
Shoreline	WA	0	2007
Goodyear	AZ	0	2008
Burlingame	CA	0	2008
Carson	CA	0	2008
Culver City	CA	0	2008
Cupertino	CA	0	2008
Foster City	CA	0	2008
Lakewood	CA	0	2008
Los Gatos	CA	0	2008
Milpitas	CA	0	2008
Moorpark	CA	0	2008

City	State	Milestones	Year
Mountain View	CA	0	2008
Pacifica	CA	0	2008
Redwood City	CA	0	2008
San Bruno	CA	0	2008
South Gate	CA	0	2008
Stockton	CA	0	2008
Ventura	CA	0	2008
Visalia	CA	0	2008
Westminster	CO	0	2008
Cutler Bay	FL	0	2008
Delray Beach	FL	0	2008
Savannah	GA	0	2008
Algonquin	IL	0	2008
Lake Forest	IL	0	2008
Springfield	IL	0	2008
Urbana	IL	0	2008
South Bend	IN	0	2008
Prairie Village	KS	0	2008
Salem	MA	0	2008
Wellesley	MA	0	2008
Bowie	MD	0	2008
Oakdale	MN	0	2008
Helena	MT	0	2008
Cary	NC	0	2008
Cortlandt	NY	0	2008
Orangetown	NY	0	2008
Ossining	NY	0	2008

City	State	Milestones	Year
Southampton	NY	0	2008
Beaverton	OR	0	2008
Corvallis	OR	0	2008
Milwaukie	OR	0	2008
Mt. Lebanon	PA	0	2008
Greenville	SC	0	2008
Spartanburg	SC	0	2008
College Station	TX	0	2008
Coppell	TX	0	2008
El Paso	TX	0	2008
Richardson	TX	0	2008
Bothell	WA	0	2008
SeaTac	WA	0	2008
Oshkosh	WI	0	2008

APPENDIX B: PEARSON CORRELATION TABLE

Correlations																
		milestones	**population**	**% bach**	**% unemployed**	**% car dependency**	**median income**	**% poverty**	**% vote obama**	**% white**	**% carbon employment**	**HAP emissions**	**enviro nonprofits**	**population density**	**state initiatives**	**Years in ICLEI**
Pearson Correlation	**milestones**	1.000	.251	-.004	.078	-.314	-.190	.170	.189	-.052	-.130	-.244	.171	.240	.023	.527
	population	.251	1.000	-.135	.174	-.331	-.141	.141	.094	-.245	.033	-.149	-.085	.536	-.050	.249
	% bach	-.004	-.135	1.000	-.602	-.228	.613	-.289	.148	.340	-.609	.252	.213	-.074	.116	.054
	% unemployed	.078	.174	-.602	1.000	-.130	-.592	.594	.040	-.521	.250	-.305	-.064	.222	-.173	.140
	% car dependency	-.314	-.331	-.228	-.130	1.000	.135	-.349	-.419	.202	.455	.143	-.311	-.570	-.178	-.342
	median income	-.190	-.141	.613	-.592	.135	1.000	-.808	.212	.140	-.040	.406	-.160	-.078	.392	-.169
	% poverty	.170	.141	-.289	.594	-.349	-.808	1.000	-.123	-.159	-.166	-.394	.239	.102	-.350	.193
	% vote obama	.189	.094	.148	.040	-.419	.212	-.123	1.000	-.380	-.117	.135	-.010	.386	.341	.198
	% white	-.052	-.245	.340	-.521	.202	.140	-.159	-.380	1.000	-.299	.094	.227	-.406	-.032	-.050
	% carbon employment	-.130	.033	-.609	.250	.455	-.040	-.166	-.117	-.299	1.000	-.017	-.322	-.011	.102	-.172
	HAP emissions	-.244	-.149	.252	-.305	.143	.406	-.394	.135	.094	-.017	1.000	-.069	.087	.253	-.134
	enviro nonprofits	.171	-.085	.213	-.064	-.311	-.160	.239	-.010	.227	-.322	-.069	1.000	-.083	-.072	.153
	population density	.240	.536	-.074	.222	-.570	-.078	.102	.386	-.406	-.011	.087	-.083	1.000	.285	.283
	state initiatives	.023	-.050	.116	-.173	-.178	.392	-.350	.341	-.032	.102	.253	-.072	.285	1.000	.034
	Years in ICLEI	.527	.249	.054	.140	-.342	-.169	.193	.198	-.050	-.172	-.134	.153	.283	.034	1.000

VITA

Kelsey Clinton was born in 1986 and grew up in Bellingham, Washington (The City of Subdued Excitement). During high school Kelsey participated in the National Ocean Sciences Bowl, which sparked her interest in environmental issues. Kelsey graduated high school in 2004 and continued her education at the University of Washington, where she majored in geography. After studying abroad in Sweden, Kelsey graduated at the end of 2007. Her first job was at the Marine Science Consortium in Virginia, where she taught environmental education. After that, Kelsey interned at the Rails-to-Trails Conservancy in Washington, DC, volunteered at Sierra Nevada Journeys in Reno, Nevada, and worked as an environmental educator at Hunt Hill Audubon Sanctuary in Wisconsin. In August 2010 Kelsey came to LSU to pursue her master's degree in environmental science. At LSU Kelsey was involved with the EnvironMentors program and was an education and outreach officer in CEGO. After graduating Kelsey will spend the summer teaching environmental education in Alaska before journeying on to another adventure.