

THE POLITICS OF CLIMATE ADAPTATION

BY

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ABSTRACT

Emerging research highlights increasing subnational activity on climate change. While most researchers explore mitigation of climate change, far less attention has been directed towards climate adaptation. In this dissertation I explore the sub-national politics surrounding climate adaptation in the United States through three broad questions. 1) At the state level, why do some states adopt adaptation plans while others do not? Are there any emerging patterns among predictors for policy, and do these vary across policy adoption (yes/no) and policy goals and ambitiousness? 2) Within urban politics, in what ways do local politics shape adaptation efforts given the relative risks faced by cities and the broader political context of climate decision-making? Are there differences in factors predicting commitment across size - mainly small, medium and large cities? And 3) to better understand the quality of collaborative partnerships in adaptation planning, I ask multiple interrelated questions such as which agencies are more likely to collaborate with one another to develop and implement strategies for climate adaptation, and do we see any patterns among these partnerships? Which stakeholders are involved in building climate resilience, and what are the means and tools used for these collaborations? Further, what is the importance given to collaboration within adaptation policy documents, and at what stages of the policy process are these partnerships most evident? The findings from this research contribute to the Diffusion of Innovation (DOI) theory, collaborative governance and public participation, and well as environmental decision-making on climate change adaptation among states and local governments.

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INTRODUCTION

"This one trend, climate change, affects all trends... If we let the world keep warming as fast as it is and sea levels rising as fast as they are, and weather patterns keep shifting in more unexpected ways, then before long we are going to have to devote more and more and more of our economic and military resources not to growing opportunity for our people, but to adapting to the various consequences of a changing planet."

- U.S. President Barack Obama (Paris Agreement Talks, Dec 2015)

Climate change is defined as *"a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods"* (UNFCCC, 1992; pp.7). Climate change will impact societies and ecosystems in myriad of ways globally and in the United States. Within North America, climate related changes are already visible and expected to continue. Increase in air and water temperatures, reduced frost days, increased frequency and intensity of extreme weather events, rise in sea level, and reduced snow cover are a few ways climate change is impacting communities and the economy (EPA, 2014). For example, average winter temperatures have increased by more than 7⁰F in the Midwest and northern Great Plains over the past 30 years, and coastal areas have witnessed more intense hurricanes and related storms (Karl, Melillo, & Peterson, 2009). Hurricane Katrina and Sandy are examples that illustrate potential for damage to human life and property from extreme weather events.

Often termed a 'wicked problem', climate change is complex, spans different spatial and temporal scales, and involves diverse actors and institutions. Geographically, the problem ranges from a local city or town to the national and global scale. This wide spatial dimension is compounded by the fact that action in one location (e.g. emissions released in India and China)

can have a far reaching impact on a geographic space thousands of miles away (e.g. ice sheet melt in Greenland, sea level rise and inundation of small island countries in the Pacific Ocean).

Climate change is multi-dimensional, and cuts across different departments and bureaucracies, at all levels of government. The mitigation aspect of the problem (emissions) spans various sectors including energy, agriculture, land-use, transportation and construction; while the adaptation aspect can involve water, food, health and poverty. There are numerous stakeholders involved with industry, public and private sector, civil society actors, and the citizenry spread across geographically within and beyond national borders. The issue also includes an inter-generational component that aims to incorporate future generations into the scope of the problem (Adger et al., 2005). Different actors have large economic and survival factors at stake, and the risks, resources and incentives are unevenly distributed.

As an issue, climate change also involves complex scientific and technical information. There are large risks and uncertainties, and these are spread over long timeframes, spanning beyond a decade to the next 50 to 100 years. These features of climate change pose a challenge to the governance of the problem. The complexity of scale, actors, and scope make it difficult to reach consensus on how responsibility and resources for the problem can be allocated, coordinated and enforced.

Impacts of climate change elicit action on mitigation (by reducing greenhouse gas emissions) to minimize harm to the climate, as well as developing adaptation strategies¹ to adjust to the inevitable impacts of climate change on individuals, communities, businesses and countries. The U.S. Global Change Research Program has been preparing National Climate

¹ Intergovernmental Panel on Climate Change (IPCC) describes adaptation as “*Practical steps to protect countries and communities from the likely disruption and damage that will result from effects of climate change*” (IPCC-TAR, 2001; pp.4).

Assessments since the late 1990s. These reports are submitted to the United Nations Framework Convention on Climate Change (UNFCCC) as part of a national commitment to the framework. However, these national assessments have not translated into cohesive federal policy with financial commitments for both mitigation and adaptation measures (USGCRP, 2013). It was not until 2009, under President Obama's administration, an *Interagency Climate Adaptation Task Force* was created to assess impacts and recommend programs and policies for the nation. Within this federal policy void, much as the historical pattern with emergence of environmental policy in the U.S., state and local governments have taken a lead for the mitigation and adaptation to climate change (Rabe, 2004).

To understand the challenges and solutions to climate change, scholarship on the subject has emerged within an interdisciplinary background. This new critical field comprises climate scientists, ecologists, environmental lawyers, NGOs, and other experts, but the presence of political scientists is almost missing (Javeline, 2014). While some studies have emerged on climate mitigation (Laukkonen et al., 2009; Lutsey & Sperling, 2008; Peterson & Rose, 2006; Pollak, Meyer, & Wilson, 2011; Vivian & Vicki, 2011; Wheeler, 2008; Zimmerman & Faris, 2011), the sparseness in research is more apparent for adaptation to climate change.

Research Agenda: There is urgency to fill this gap in literature given that almost all technical advances in adaptation are dependent on political factors for their adoption, implementation and effectiveness (Javeline, 2014). Scholars suggest that the politics surrounding adaptation will be different from mitigation as it does not present the same collective action problems (Niles & Lubell, 2012). For example, resilience initiatives undertaken by a government, such as improvement in water supply and storage infrastructure, will benefit its jurisdiction irrespective of whether other jurisdictions take similar measures. Conversely,

mitigation measures to reduce emissions within the same jurisdiction would not necessarily result in benefits of reduced climate change impacts, if other governments and individuals do not undertake similar measures (free-rider problem).

This demands a separate investigation of climate adaptation. Political science subfields such as political economy (costs of adaptation), political theory (justice), urban politics, public opinion and federalism are some key areas of critical thinking that have the potential to broaden our understanding of climate change adaptation in the United States.

Preliminary adaptation studies in the U.S. have mainly been case study research or have qualitatively analyzed the content of state and local climate action plans (Baker, Peterson, Brown, & McAlpine, 2012; Preston, Westaway, & Yuen, 2011; Tang, Brody, Quinn, Chang, & Wei, 2010; Wang, 2013; Zahran, Brody, Vedlitz, Grover, & Miller, 2008). These findings are valuable and have contributed to the initial understanding of adaptation planning. However, being limited in their scope, the findings are not generalizable and many questions remain unanswered. The scholarship still lacks a thorough understanding of the real politics surrounding climate adaptation.

This dissertation examines policies at the sub-national level that increase resilience and adapt to climate change. I aim to identify important trends and contribute to new knowledge to the study of climate adaptation in the United States. Many questions need to be asked within this broader research program; however, this work will focus on three areas:

Chapter 1: Politics of Adaptation: Vulnerability, Diffusion & State Adaptation

Policy: Since the year 2008, many state governments have developed their own stand-alone State Adaptation Plans (SAPs). With no federal standard approaches to climate adaptation planning, these plans vary widely on length, number of goals, timeframe for action, and tools and

mechanisms applied. To date 14 state governments have adopted plans, while 9 more are in process. Given this growth in adaptation plans, I ask the question, why do some state governments adopt climate adaptation policies while others do not? What factors predict the emergence of policies and are there any patterns for policy adoption and the number of goals and strategies set by different states?

Chapter 2: When Size Matters: Predictors of Adaptation Planning in Small, Medium and Large U.S. Cities: Even with federal and state government action, the role of cities will remain pertinent to developing policy solutions for climate change. Local governments have jurisdiction over various adaptation policy sectors such as transportation, drinking water, land use and infrastructure which are more likely to be tailored to the local climate impacts. Currently there are only 22 local governments² that have their own adaptation plan. Interestingly, 117³ local governments have signed the *Compact of Mayors* agreement, and 174 mayors have signed the *Resilient Communities for America Agreement (RC4A)*, committing to concrete adaptation planning.

These developments demand a better understanding of factors that lead to city action for climate preparedness. I ask, in what ways do local politics shape adaptation efforts given the relative risks faced by cities and the broader political context of climate decision-making? Why are some cities more likely to commit to or engage in climate adaptation planning than others? I also delve deeper and investigate differences in factors predicting adaptation commitment across city size - mainly small, medium and large cities.

² These number is excluding County-level government adaptation plans and action

³ These number is excluding County-level government adaptation plans and action

Chapter 3: Unpacking the Collaboration “Black-Box” – A Framework to Analyze

State Adaptation Plans: The impacts of climate change are heterogeneous and cut across typical political and economic boundaries. Successful adaptation to adverse impacts stemming from climate change will thus require a high level of collaboration between multiple levels of governments and a range of stakeholders. Planning documents are indicative of the commitment of action by government authorities. To better understand the quality of collaborative partnerships in adaptation planning, I develop an adaptation plan analysis framework that asks multiple inter-related questions – Which agencies are more likely to collaborate with one another to develop and implement strategies for climate adaptation, and do we see any patterns among these partnerships? Which stakeholders are involved in building climate resilience, and what are the means and tools used for these collaborations? Further, what is the importance given to collaboration within adaptation policy documents, and at what stages of the policy process are these partnerships most evident?

For each of these three main chapters, I provide the relevant research, the theoretical background, discuss the hypothesis to be tested, the research design, share the data and methods, and present my results and discussion. Lastly, I provide a brief conclusion and way forward.

CHAPTER 1

POLITICS OF ADAPTATION: VULNERABILITY, DIFFUSION & STATE

ADAPTATION POLICY

1.1. INTRODUCTION

Human induced climate change is occurring, and the consequences stemming from climate change will be wide-ranging and significant. Climate related natural disasters are expected to increase in both frequency and intensity. Hurricane Katrina and Sandy illustrate the high potential for damage to human life and property from extreme weather events. Changes in air and water temperatures, reduced frost days, reduced snow cover and sea level rise are some of the ways climate change is impacting American communities and the economy (CEQ, 2011; EPA, 2014; IPCC, 2014; Karl et al., 2009).

Action to address climate change can focus on mitigation strategies to reduce GHG emissions, and on adaptation strategies to buffer communities from the inevitable impacts of climate change. Despite growing scientific evidence, there is little consensus on how to address climate change in the United States. Federal action on mitigation and adaptation policy has been limited. While, national climate assessments have been prepared since the 1990s, these reports have not resulted in any cohesive federal policy (Smith et al., 2010; USGCRP, 2013).

Interestingly, many state and local governments across the United States are developing a range of climate mitigation and adaptation plans to address climate change (Glicksman, 2010; Rabe, 2008; Smith et al., 2010).

A range of scholars have examined the development of subnational climate policy in the U.S. (Carley & Miller, 2012; Huang et al., 2011; Krause, 2012; Peterson & Rose, 2006; Pollak et al., 2011; Sharp et al., 2011; Stoutenborough & Beverlin, 2008; Wheeler, 2008; Zimmerman & Faris, 2011). This work sheds light on why state and local governments adopt and implement climate mitigation policies (Betsill, 2001; Jones & Levy, 2007; Laukkonen et al., 2009; Lutsey & Sperling, 2008; Rabe, 2004, 2008, 2010; Sharp et al., 2011; Zahran et al., 2008). Climate adaptation, in comparison, is relatively unexamined.

Adaptation measures are defined as steps taken by governments and communities to address the likely disruption and damage from effects of climate change (IPCC-TAR, 2001; pp.4). There is clear evidence that even if governments take action to reduce emissions, communities will still experience a range of climate related events, and many of these will have negative consequences for economies and human life (IPCC, 2014; USGCRP, 2013). Therefore, exploring adaptation policy is critical. Measures for adaptation will require significant changes across many sectors such as agriculture, water, public health, and conservation. And each of these plans and strategies requires the commitment and investment of policymakers. Despite politics and governments playing a key role in successful adaptation, currently there is very little political science research that focuses on climate adaptation (Javeline, 2014).

This chapter examines the factors that predict the emergence of State Adaptation Plans (SAPs). I ask the question - why are some states adopting adaptation policies while others are not? What factors predict emergence of these state level policies? The study applies the Diffusion of Innovation (DOI) theory to better understand why some state governments formerly engage in climate adaption planning, and others do not (Berry & Berry 1994, 2007). I consider the relative influence of internal state characteristics, such as problem severity, citizen demand,

state fiscal capacity and interest group pressures along with testing the impact of external pressure driving the development and level of commitment to climate adaptation. Applying a panel data analysis from 2009 to 2015, I test this theory using two dependent variables. The first is a basic measure of policy adoption, noting if a state has adopted its State Adaptation Plan (SAP) or not. The second dependent variable captures the intensity of a state's commitment to climate adaptation by measuring the number of goals articulated in these plans. I find that both internal determinants and external pressure matter. First, increased geographic and human vulnerabilities and prevailing ideology of the mass public influence a state's decision to create formal adaptation plans. States along coastal regions and with liberal citizens are more likely to adopt SAPs, and are also more ambitious in their goals for these plans. Second, interest group pressure from the carbon intensive industry significantly reduces the likelihood of a state taking adaptation measures. States with higher contribution of the carbon industry to their GDP are more likely not to adopt SAPs or choose more conservative goal targets and possibly resemble symbolic policies.

However, I also find some difference among factors that predict policy adoption and policy ambition. My results suggest that while community vulnerabilities and poverty levels motivate states to adopt, these are not significant predictors to influence higher number of policy goals. Further, pressures from environmental groups are not influential in actual policy adoption, but this pressure seems to propel states to set higher number of strategies in their plans. Finally, EPA regions are important conduits for diffusion. It may be that regional staff serve as an information resource and encourage state decision makers to embark on adaptation planning.

These findings advance our understanding of which factors tend to influence policymakers in decisions on climate adaptation policies. The study highlights potential barriers and pressures

for policy action related to climate adaptation. It also contributes to DOI theory by testing dependent variables that go beyond the dichotomous 'yes/no' variables, by capturing more descriptive variables like the intensity of policy commitment. The results show interesting trends in climate adaptation politics. This paper proceeds as follows: first I provide a background to climate adaptation policy in the United States and outline the theoretical framework. Next, I describe my methods and data and then present my results and discussion. I conclude the paper with avenues for future research.

1.2. CLIMATE ADAPTATION POLICY

Climate adaptation and mitigation strategies are both required for effective climate policy. Mitigation alone is insufficient as substantial impacts from climate change are already unavoidable with the current levels of greenhouse gas (GHG) emissions in the atmosphere. An adaptation only policy is also inadequate as the costs to adapt become less effective with greater magnitudes of impacts (McMullen & Jabbour, 2009). A holistic climate policy thus needs a two-pronged approach with both adaptation and mitigation action. Within the United States, the emergence of climate policy has been much slower in comparison to the rest of the world, and mitigation policy has preceded adaptation by almost a decade (Moser, 2009). While the first wave of state climate mitigation plans emerged in early 2000⁴ (with the exception of Illinois's 1994 policy), adaptation policies do not appear till the year 2008.

⁴ Illinois completed its initial CAP in 1994, followed by Delaware (2000), Missouri and Rhode Island (2002), Maine, Massachusetts and Oregon (2004), Connecticut (2005), and Arizona and California in 2006.

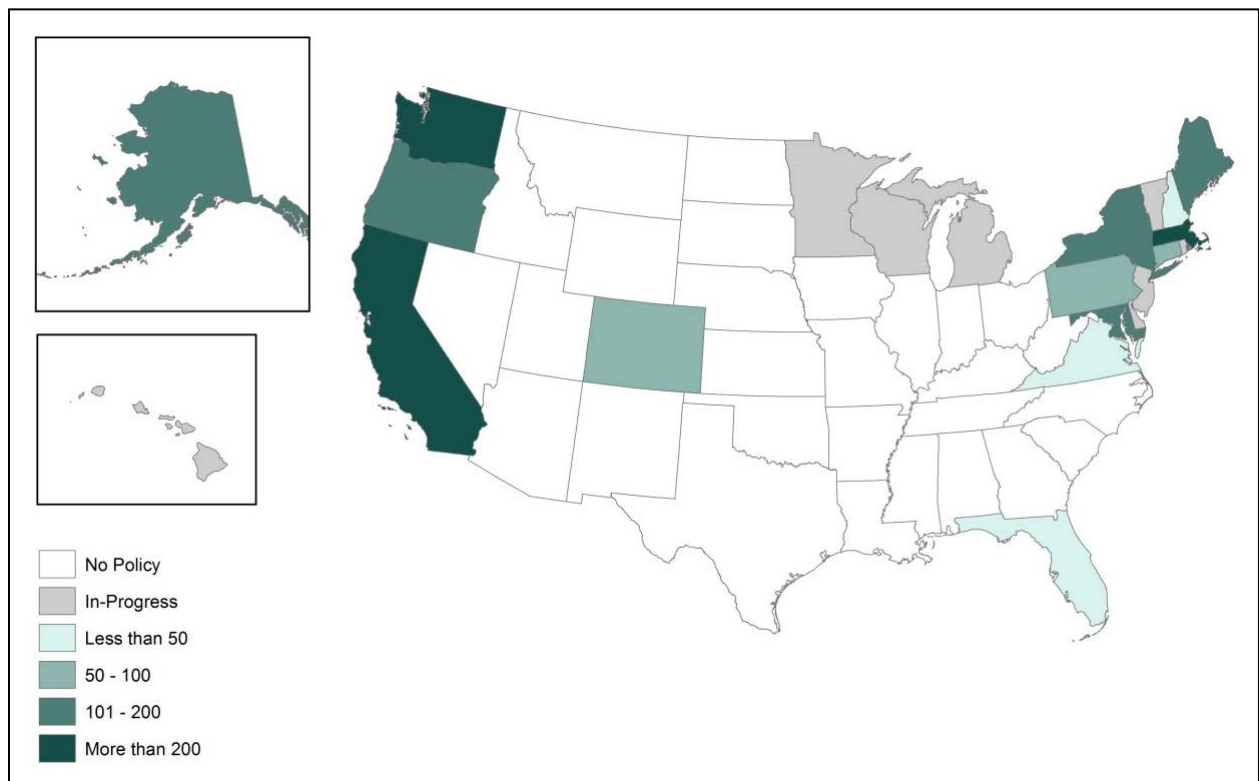
Analysis of first generation climate action plans (CAPs) show that most states set goals for emissions-reduction, propose ways to green public sector operations⁵, but were lacking in their consideration for adaptation measures (Pollak et al., 2011; Wheeler, 2008). These mitigation measures are expected to emerge when there is increased deaths and injuries by extreme weather events, presence of citizens with more democratic views, interest group pressures such as number of environmental organizations (Zahran et al., 2008; Huang et al., 2011; Peterson & Rose, 2006; Pollak et al., 2011; Zimmerman & Faris, 2011), as well as characteristic of the institutional structure (Krause, 2011, 2013; Sharp et al., 2011). There is also evidence of the carbon-intensive industry playing a role in reduced support for climate mitigation (Krause, 2013; Zahran et al., 2008)

These initial findings broaden our understanding of mitigation policies. However, climate adaptation is fundamentally different from mitigation. Private benefits are greater from adaptation measures and may increase its likelihood of adoption in comparison to mitigation action (Easterling et al., 2004; Niles & Lubell, 2012). This difference requires a separate investigation into adaption policy to understand factors surrounding politics of climate adaptation.

To date, 14 states have State Adaptation Plans (SAPs) and 9 other states are in the process of finalizing plans (C2ES 2012; Georgetown Climate Center 2015) (See Figure 1.1 with map of overview of State Adaptation Plans). Strategies within these SAPs broadly fall within 9 sectors identified by the EPA – mainly Agriculture, Biodiversity, Coasts/Oceans, Forestry, Emergency Preparedness, Public Health, Infrastructure, Water and a miscellaneous group of

⁵ Studies investigating energy policies find that state and local energy efficiency measures have the potential to reduce national CO₂ emissions by 65% against baseline projections (Byrne, Hughes, Rickerson, & Kurdgelashvili, 2007).

‘Other’. These plans elaborate action within each sector – for example, the infrastructure sector for Massachusetts includes measures for energy, transportation, dam safety and flood control, solid & hazardous waste, built infrastructure and telecommunications. The strategies are devised based on current and anticipated climate impacts.



Source: Institute for Policy & Social Research, The University of Kansas; Data from Georgetown Climate Center. The map provides an overview of the number of goals set by states in their State Adaptation Plans (SAPs). States with plans =14; In-progress=8; No plan=28

Figure 1.1: Overview of State Adaptation Plans

A good example is New York’s SAP which identifies climate impacts in each sector and links goals with preparing for these impacts. The plan also estimates costs, timeframe for impacts and action, co-benefits and environmental justice considerations with the goals (Georgetown Climate Center, 2015). Further, many states have also created sector specific plans that have often emerged even in the absence of an overarching state policy. The state of Arizona is an example with sector specific and local adaptation plans with no comprehensive state level policy.

Given adaptation activities are relatively new in the United States, peer-reviewed literature is still limited (Bierbaum et al., 2013). Existing adaptation studies have qualitatively analyzed the content of state and local climate action plans (Baker et al., 2012; Preston et al., 2011; Tang et al., 2010; Wang, 2013). These studies find that the climate-specific action by states focus mainly on planning, with limited goals for capacity building and evaluation (Bierbaum et al., 2013; Preston et al., 2011; Smith et al., 2009). Common strategies include research and education, and integration of measures into existing planning and policies (Bierbaum et al., 2013; Füssel, 2007, 2008; Hamin, 2012; Hamin & Gurrán, 2012).

While these findings discuss the quality of existing plans and strategies, there is a need for deeper investigation. There is limited understanding of why state plans vary with regard to their quality and ambitiousness, and furthermore why some states are more likely to adopt policies than other. Do patterns emerge and what predicts state adaptation policy adoption? Building on previous work, my paper explores these questions by testing the influence of various state socio-economic and political factors, as well as problem severity on the likelihood of policy adoption. I investigate key factors that are influential in mitigation studies to test if predictors for adaptation follow similar trends.

1.3. DIFFUSION OF INNOVATION THEORY

DOI theory explains why some governments adopt new policies while others do not (Berry, 1994; Berry & Berry, 2007; Shipan & Volden, 2012). The theory identifies two broad explanations for policy making: internal determinants and external pressure (Berry, 1994; F. S. Berry & Berry, 1990, 2007; Mintrom & Vergari, 1998). Internal determinants suggest that factors internal to a government shape its decision to develop a new policy or program. This can

include things like fiscal resources, the nature or severity of a problem within the jurisdiction, and citizen demand. By contrast, external pressure or diffusion focuses on factors external to a government that may sway its policy making. Diffusion mechanisms can include learning from neighboring jurisdictions or leaders in the field, or developing policies to compete with nearby governments.

Internal Determinants

The internal determinants model contends that state policymakers respond to internal characteristics of their state when adopting a new program or policy. Previous research suggests that political, social, and economic characteristics are motivators, obstacles or resources to overcome obstacles for states (Hays & Glick, 1997; Mooney & Lee, 1995; Walker, 1969). For example, the severity of the problem is an important motivator for states to emphasize the need for policy. State policy makers respond to environmental problems by mitigating concerns through policy adoption (Feiock & West, 1993; Lester et al., 1983; Ringquist, 1994). Scientific evidence indicates that climate change will have various impacts on states, including damage to human life, property and ecosystems. If states are initiating measures to reduce climate impacts, they are more likely to adopt SAPs.

Hypothesis 1: States with more severe climate impact problems will be more likely to adopt SAPs. Moreover, states facing more severe problems stemming from climate change will be more likely to articulate a broader range of goals within their SAP.

Citizen ideology and institutional structure of states matter. Policymakers are receptive to their electorate (Ringquist, 1993, 1994; Teske, 2004). Under the assumption that the goal of

elected officials is to win reelection, they initiate action to respond to the mass opinion within their state (Kiewiet & McCubbins, 1985). Prior research indicated that more liberal citizens support more climate policy action (Hamilton, 2011) and policy makers are influenced by the opinion of citizens on climate change (Brulle et al., 2012). Taken together, this suggests that when states have more liberal residents, the likelihood of action on climate adaptation should increase.

Hypothesis 2a: States with more liberal citizens are more likely to adopt SAPs, and articulate more goals, than states that have more conservative populations.

With regard to institutional structure, democratic government institutions are more supportive of action for social welfare policies, including environmental protection (Berry et al., 1998; Ringquist, 1994). Liberals are more willing to support government solutions for environmental problems, and this pattern is also expected to hold for climate adaptation.

Hypothesis 2b: States that have more Democratic government institutions are more likely to adopt SAPs than states where Republicans control one or more branches of government.

Fiscal health of a state often has positive impacts on propensity to adopt new policies (Allard, 2004; Lowry, 2005). Policy action entails costs, and states with more resources and wealth are in a better position to develop and implement policy measures (Daley & Garand, 2005; Dye, 1965; Gray, 1973). A key challenge for climate adaptation policies is the cost of adaptation (Bierbaum et al., 2013; Biesbroek et al., 2013; Measham et al., 2011; Moser & Ekstrom, 2010).

This relative cost is often identified as a barrier to adaptation policies. States with more economic capacity are in a relatively stronger position to act on adaptation both in terms of policy adoption and policy ambition.

Hypothesis 3: States with higher economic resources and capacity are more likely to adopt SAPs. Moreover, state wealth is expected to be positively correlated with the level of intensity of an SAP.

Policymakers also respond to interest group pressure. Previous studies show that organized interests do influence policy adoption, but often a modest effect in comparison to other variables (Davis & Feiock, 1992; Erikson et al., 1993; Teske, 2004; Williams & Matheny, 1984). Interest group pressure on climate adaptation can be both supportive and oppositional. Oppositional pressure is likely to emerge from carbon intensive industries who may be threatened by any action on climate change (Krause, 2011; Zahran et al., 2008). On the other hand, supportive pressure is likely to emerge from environmental groups and other stakeholders who are invested in institutionalizing positive change.

Hypothesis 4a: Greater presence of carbon intensive industry in a state will reduce the likelihood of states adopting SAPs, and reduce the corresponding intensity of ambitiousness.

Hypothesis 4b: States with larger environmental communities will be more likely to adopt SAPs, and will have higher likelihood of more ambitious goals.

When policymakers gain experience on implementing a plan on a similar issue, it is easier for them to adopt more measures in the area. Through previous experience they tend to form networks, identify who their allies and opponents are, and generate policy knowledge on the substantive issue (Berry & Berry 2007). Such experiences are likely to reduce the intensity of initial hurdles for policy adoption on similar issues (climate adaptation). Given the need to understand climate science and its impacts to adequately address climate risks, previous experience in climate mitigation policies in a state would potentially create a more mature platform for policy action on adaptation.

Hypothesis 5: States with mitigation policies are more likely to adopt climate adaptation plans and set more ambitious goals.

State action on climate adaptation is unlikely to be driven by a singular force. Therefore, I also examine the conditional effects of the factors outlined by the DOI theory. Specifically, when severity of the problem is high, state governments, even those relatively more conservative, may take remedial action and adopt climate strategies. On the same lines, relatively more liberal state governments may tend to adopt adaptation policies faster and incorporate more intensive strategies in the plans. I test this hypothesis through a conditional effects model.

Hypothesis 6: The conditional effect of problem severity with government ideology will likely result in more states adopting policies, and with ambitious goals to address the issue.

External Pressure

Models of state policymaking need to capture both internal characteristics of the state as well as influence of external forces to explain policy output (Berry, 1994; Berry & Berry, 2007).

There are two primary explanations of why policies diffuse from one state to another. First, states look to their ideological or geographic neighbors (Grossback, 2004) to test the successes and failures of new policies and borrow innovations perceived as successful (social learning model) (Mooney & Lee 1995; Walker 1969). Second, states compete with each other and emulate policies of other states in order to achieve an economic advantage or avoid being disadvantaged (economic competition) (Berry & Berry, 2007).

Diffusion of policy ideas across governments can occur from the federal government to state and local governments (vertical diffusion) and from one state government to another (horizontally) (Mohr, 1969; Walker, 1969). While observing actions of others, policymakers want to maintain positive policy outcomes, such as increased industry investment or improved environmental conditions, while avoiding or reducing the negative spillovers or externalities. This is often described in state politics as “race to the bottom” or a “race to the top” (Berry et al., 2003; Prakash & Potoski, 2006; Rabe, 2010; Woods, 2006).

The DOI theory suggests a positive influence of external pressure. States look to their neighbors and are more likely to adopt policies when other government units have already enacted the same (Berry & Berry, 1990; Glick & Hays, 1991). Given that climate policy action is still at a nascent stage in the United States, states will look to others for innovative programs and policy benefits. It is also expected that they will be open to sharing knowledge and resources to address the problem of climate change (Amundsen et al., 2010; Bierbaum et al., 2013).

Hypothesis 7: State policymakers are more likely to adopt SAPs if nearby states have also adopted adaptation policy (Horizontal/Regional Diffusion). And as experience is shared among neighboring states, they are more likely to prepare ambitious policies.

Diffusion can also occur vertically from the federal government to states and local agencies. Vertical diffusion is usually conceptualized as funding and regulatory pressure from the federal government to create positive incentives or pressures directed to make states behave in a certain manner (Shipan & Volden, 2006). My paper will only focus on regional or horizontal diffusion given that there is almost a complete absence of adaptation formal policy at the national level for an adequate measure of federal influences.

1.4. MODELING CLIMATE ADAPTATION POLICY

Studies testing DOI theory have predominantly focused on models that use dichotomous dependent variables for the probability of a state adopting a policy (Berry & Berry, 2007). There is recognition of moving away from the dichotomous dependent variables [DV] to better measures, like indexes, that capture the complexities of the real world (Boehmke, 2009). These measures transition from a “superficial” to “deep” analysis of policy adoption (Glick & Hays, 1991, pp.836). I test two models of policymaking. My first measure is dichotomous, simply noting if a state has developed an SAP (‘yes/no’). Currently there are 14 states with finalized SAPs.

Another way to measure the dependent variable is the level of commitment, where more goals and strategies set by a state can be indicative of more commitment for adaptation planning. For example, Florida has set 28 goals and these goals only focus on adopting formal laws and

planning and capacity building strategies. States with larger number of goals, like Massachusetts and California (at 373 and 345 goals respectively), go beyond to include goals for post-implementation and monitoring (Georgetown Climate Center, 2015).

My second dependent variable is the intensity or ambition within these plans, and is measured by the number of goals within an SAP. Investigating ambitiousness distinguishes state policies that are largely symbolic from others involving extensive commitment of resources through detailed planning and enforcement action (Downs & Mohr, 1976). It can be argued that states with more goals have given deeper consideration to ways to build resilience, and by incorporating them into state goals, are more likely to move beyond planning to actual implementation.

I primarily rely on policy data from Georgetown Climate Center's Adaptation Clearinghouse. The center collects information on adaptation policies across all levels of government – federal, state and local; and categorizes strategies within the nine sector classification used by EPA.⁶ Detailed coding processes outlines basic features of SAPs such as the total number of goals set by a state, the grouping of goals into the nine sectors, as well as whether the state goals aim to create law and policy, build capacities, and post-implementation monitoring. Information is also provided on the state's progress on goals such as whether the goals are completed, currently in progress, or have not been acted on. My dependent variables are created using this information for all 50 states.

⁶ Environment Protection Agency (EPA) uses a nine sector classification – Agriculture, Forestry, Biodiversity, Water, Coasts/Oceans, Public Health, Infrastructure and Others.

Table 1.1: State Adaptation Policy Overview

No.	State	Adaptation Plans	Date of First Adoption	Number of Goals	Goals Completed	Goals In-Progress	Sectors Diversity*
1	Alaska	Yes	2010	158	1	52	7
2	Alabama	No					
3	Arkansas	No					
4	Arizona	No					
5	California	Yes	2009	345	48	251	7
6	Colorado	Yes	2011	72	7	34	4
7	Connecticut	Yes	2013	76	2	47	8
8	Delaware	In Progress					
9	Florida	Yes	2008	28	0	16	6
10	Georgia	No					
11	Hawaii	In Progress					
12	Iowa	No					
13	Idaho	No					
14	Illinois	No					
15	Indiana	No					
16	Kansas	No					
17	Kentucky	No					
18	Louisiana	No					
19	Massachusetts	Yes	2011	373	24	191	8
20	Maryland	Yes	2008	154	3	91	8
21	Maine	Yes	2010	118	4	84	8
22	Michigan	In Progress					
23	Minnesota	In Progress					
24	Missouri	No					
25	Mississippi	No					
26	Montana	No					
27	North Carolina	No					
28	North Dakota	No					
29	Nebraska	No					
30	New Hampshire	Yes	2009	33	2	17	6
31	New Jersey	In Progress					
32	New Mexico	No					
33	Nevada	No					
34	New York	Yes	2010	121	17	63	7
35	Ohio	No					
36	Oklahoma	No					
37	Oregon	Yes	2010	122	7	53	7

No.	State	Adaptation Plans	Date of First Adoption	Number of Goals	Goals Completed	Goals In-Progress	Sectors Diversity*
38	Pennsylvania	Yes	2011	87	2	33	6
39	Rhode Island	In Progress					
40	South Carolina	No					
41	South Dakota	No					
42	Tennessee	No					0
43	Texas	No					0
44	Utah	No					0
45	Virginia	Yes	2008	43	2	5	3
46	Vermont	In Progress					0
47	Washington	Yes	2012	287	12	165	7
48	Wisconsin	In Progress					0
49	West Virginia	No					0
50	Wyoming	No					0

*Total 9 EPA Sectors

Source: Georgetown Climate Center – State and Local Adaptation Plans

States with Plans = 14; States Plans In-Progress = 8; States without Plans = 28. Total = 50.

The first adaptation policy was adopted in 2008 and states have continued to prepare policies till date. My study is a panel data analysis from 2008 to 2014, and I use 2008 as the base year for my analysis. I develop and test parsimonious models of both policy adoption and policy ambition. Since conditions from a previous year are likely to result in the next year's outcome, I lag my independent variables by one year (2007).

Independent Variables

Several different independent variables are used in this analysis to test the relative effects of internal determinants and external pressures on state decision making. Table 1.2 provides an overview of the variable description.

Table 1.2: Model Variable Description

Variables Name	Variable Operation	Sign	Data Source
<i>Dependent Variable</i>			
Policy Adoption	Dichotomous variable – states with plans coded as 1, states with no plans or in-progress coded 0 (2008).		Georgetown Climate Center
Policy Ambitiousness	Count variable - total number of goals set forth in a state adaptation plan (SAP)		Georgetown Climate Center
<i>Independent Variable</i>			
Problem severity	Per Capita total number of deaths from environmental disasters by state	+	National Oceanic and Atmospheric Administration (NOAA) (2007 – 2013)
Vulnerability	A. Total percentage of population in poverty in a state	+	American Community Survey (2007 – 2013)
	B. Length of coastline (miles) of a state	+	Statistical Abstract of United States (2012)
Political factors	<i>Citizen Ideology</i> : Average ideological positioning of active electorate on a liberal to conservative continuum	-	Berry, Ringquist, Fording, and Hansen 1998 (2007 – 2013)
	<i>Government Ideology</i> : Ideology of state’s elected officials across legislature, senate, and governors on a liberal to conservative continuum	-	Berry, Ringquist, Fording, and Hansen 1998 (2007-2013)
Interest Group Pressure	<i>Environmental Groups</i> : Per capita number of registered Sierra Club members in a State	+	The Sierra Club United States (2007-2013)
	<i>Industry Group</i> : Percent of carbon intensive industry contribution to total state GDP from 4 main sectors - Mining, Utilities, Construction, and Manufacturing	-	Bureau of Economic, U.S. Department of Commerce (2007-2013)
State Resources	Fiscal capacity - Median household income of citizens in a state	+	U.S. Census Bureau (2007-2013)
Civic Engagement	Percent of state urban population	+	U.S. Census Bureau (2010)
Policy Experience	Adoption of Mitigation Action Plans	+	Center for Climate &

Variables Name	Variable Operation (coded 0=no policy, 1=policy adopted)	Sign	Data Source Energy Solutions(C2ES) (2007-2013)
Horizontal Diffusion	Percent of number of states within an EPA region group that have adaptation plans. Total of 10 EPA regions.	+	U.S. Environmental Protection Agency – Regional Offices

*Sign – Direction of influence

Problem severity: Climate change is expected to have many impacts such as the increase in frequency and intensity of extreme weather events, lead to large temperature fluctuations, and sea level rise (IPCC, 2015). The National Oceanic and Atmospheric Administration (NOAA), is one of the leading organizations in the nation that monitors and measures these weather related changes. This includes information on number of severe weather incidents, their economic impacts on crops and property, and the number of direct and indirect injuries and deaths resulting for the events. In the interest of keeping my models parsimonious, I select the most appropriate indicator – human loss.⁷ I measure the intensity of problem of climate change through the impacts of environmental disasters on number of deaths in a state. Previous studies have used number of fatalities and injuries to reflect greater threat from environmental disasters (Battersby et al., 2011; Borden & Cutter, 2008; Born & Klimaszewski-Blettner, 2013; Boruff et al., 2005; Zahran et al., 2008).

Vulnerability: I capture both human and geographic vulnerabilities of states in my models. While a specific region may face similar climate events, the impacts on community are highly dependent on their coping capacity to withstand the risks. Climate adaptation discourses

⁷ I refrained from aggregating number of disasters across counties as there is large variation in the geographic size and number of counties within states. A mere average would not provide the true picture for state comparison. Total economic damage and human loss are better aggregated both conceptually and statistically.

point to economic capacity being a key factor in determining the potential for communities to withstand climate risks (IPCC 2014). I use the percentage of population in poverty in a state as a measure of community vulnerabilities. Previous studies have also shown that coastal regions are relatively more vulnerable to impacts of severe storms and sea level rise (IPCC 2014, Zahran et al., 2008). I use the measure of the total coastline of a state from the Statistical Abstracts as a proxy for higher geographic vulnerabilities.

Citizen Ideology and Institutional Structure: The indicator for citizen ideology measures the average ideology of the active electorate (on the same continuum from liberals to conservatives). Citizen opinions are captured on various salient policies and vote preferences to create a citizen score for each state (See Berry et al. 1998 and 2010 for more detail). The citizen ideology score thus represents the average ideological preference of the mass public.

Berry et al. 1998 (updated 2010, and 2015) provide widely used indicators for both citizen ideology and state government ideology. Institutional ideology is created through a combination of measures that represent the “center of gravity” of the state’s elected officials on a continuum from liberals to conservatives (pp.3).⁸ This measure reflects both chambers of a state legislature along with ideology of the governor. I use this measure to represent government ideology across the key institutions that play an important role in passing state policies and laws.

Interest group influence: To capture environmental interest group pressure I utilize the record of Sierra Club Memberships in a state. This data is only available on request from the organization’s national office. I calculate the per capita Sierra membership for each state as an

⁸ Berry et al. 1998 – State Institutional Ideology calculated from the weighted average of the ideological position of each of five institutional actors - (i) the Democratic delegation in the state house, (ii) the Republican delegation in the state house, (iii) the Democratic delegation in the state senate, (iv) the Republican delegation in the state senate, and (v) the governor

indicator for pro-environmental and climate action pressure on policymakers. While I expect environmental groups to support climate adaptation policies and lobby for more ambitious policies, climate change, and climate adaptation in particular, is also likely to motivate oppositional interest groups.

Scientific evidence shows that climate change is caused by the release of GHG emissions, especially carbon dioxide into the atmosphere. These emissions are released primarily through the burning of fossil fuel. Climate policies require fossil fuel or carbon-based industries to reduce their emissions by either using less fuel or switching to cleaner sources of energy (IPCC, 2007, 2014). These changes will eventually come at a cost to industries, leading to likely opposition for all climate related policies - mitigation and adaptation (Brulle, 2014; Dunlap & Jacques, 2013; Dunlap & McCright, 2011; Jacques et al., 2008; Oreskes & Conway, 2010).

I capture this opposing pressure through the presence of carbon intensive industries in a state. I aggregate the GDP from the mining, utilities, construction and manufacturing sector and calculate the percent of carbon intensive industry contribution for each state. These two variables are commonly used to capture the relative strength of industry versus environmental interest among states (Ringquist 1993; Miller, 2002; Pollak et al., 2011).

State Capacity: The capacity of a state's economy can be measured by several variables, including per capita income, gross domestic product (GDP), and level of urbanization (William et al., 1987; Daley & Garand, 2005; Walker, 1969). Here I consider a state's economic conditions and civic engagement. States with higher levels of economic development have greater probability of adopting policies, and greater personal income by state's citizens leads them to demand better government services. I include a measure of median household income per capita to capture economic capacity and percent urban population for the same.

Table 1.3: Descriptive Statistics of Variables

Variable	Mean	Std. Dev.	Min	Max
<i>Dependent Variable</i>				
Policy Adoption	0.20	0.400	0	1
Policy Ambition	28.06	74.137	0	373
<i>Independent Variable</i>				
Deaths from disasters	0.00000283	0.00000770	0	0.0001792
Poverty rate	23.97	3.00	17.60	31.40
Coastline length	863.70	3945.76	0	28162.26
Citizen ideology	51.44	15.81	8.44	95.97
Government ideology	48.95	25.54	0	92.45
Sierra Club membership	0.0019	0.00103	0.00043	0.00644
Carbon industry presence	22.31	7.05	9.02	53.03
Median household income	54599.94	8409.897	37173	78632
Urbanization rate	72.40	14.67	38.12	94.95
Mitigation policy adoption	0.394	0.489	0	1
EPA regional adoption	0.16	0.24	0	1

Policy Experience: The Center for Climate & Energy Solutions (C2ES) provides a database for state’s experiences in various policies, among others, on reducing GHG emissions. While there are a range of actions currently undertaken, I focus on the most similar measure to climate adaption plans by examining whether states have implemented State Action Plan on mitigation. I create a dichotomous variable for whether such policies are in existence as a measure for previous experience on climate policies.

Horizontal Diffusion: In the absence of federal adaptation policies, my paper focuses on horizontal effects or external pressures from a state’s neighbors. In the context of environmental policies, states work together through their Environmental Protection Agency (EPA) regional

offices.⁹ These offices provide a platform to share information and pool resources for environmental protection, including action for climate change. It is expected that states within regional groups will influence each other on policy decisions. For each state, I measure the strength of external pressure through a moving average that calculates the percentage of states within an EPA region adopting policy (excluding the current state). This reflects the strength of group action or inaction pressure on an individual states policy choice.

After merging the data, I test two separate models of policy making. First, I use logistic regression to predict the likelihood of a state adopting an adaption plan or SAP. My second model predicts the intensity or ambition of the SAP. For this model, my dependent variable is count data. Therefore, I rely upon negative binomial regression to test the relative influence of internal factors and external pressure on the intensity of an SAP. The negative binomial is preferred for count data (here the count of goals in SAPs), especially with over-dispersed data.¹⁰ I also include a conditional effect in my models. I test the influence of the severity of the problem on government ideology to examine if policymakers are more likely to respond to the problem, even in conservative institutional settings. I run both models with the same set of independent variables, and separately for all direct predictors and those with conditional effects to test influences on adoption and ambition among states.

1.5. RESULTS

The descriptive statistics of our variables and results of our models are presented in Table 1.3 and Table 1.4 respectively. In keeping with past research on DOI theory, both internal

⁹ EPA has 10 Regional Offices. For more detail on grouping visit www2.epa.gov/aboutepa/visiting-regional-office

¹⁰ The Standard Deviation of our variable is greater than the Mean. In such situations, the Negative Binomial Regression is preferred over Poisson Models for count variables.

determinants and external pressures are significant predictors of state policymaking. I discuss the findings in the context of what factors matter for states to adopt climate adaptation policies (policy adoption), and what factors influence the level of intensity within an SAP (policy ambitiousness).

With growing impacts of climate change, the severity of the problem and communities vulnerabilities to these impacts is expected to have bearing on policy choices. I find that proximity to coastal areas significantly matters for states in adopt policies and setting higher number of goals. Interesting, the level of poverty within a state is significant for policymakers adopting a policy, but does not influence the goals or its ambitiousness. States are more likely to respond to human vulnerabilities in considering an action plan, but once the plan is adopted, the level of poverty is unlikely to influence the goals set.

While vulnerability is a significant predictor for adoption, as expected, the economic capacity of states also plays a role. States with higher median incomes are significantly more likely to innovate and adopt SAPs. State wealth, however, is modestly significant for policy adoption. This partially fits previous findings that identify the need for resources to overcome obstacles that states face while innovating or implementing new policies. When states have good fiscal health, they are able to finance public services that boost the state's propensity to innovate (Daley & Garand, 2005). I find that once a state adopts an SAP, its economic capacity significantly influences the ambitiousness of the strategies adopted. This could imply that economic capacity is an incentive for policymakers to invest in preparation of detailed strategies and implementation plans. The motivation to move from 'shallow' to 'deep' policies is thus driven by state economics (Berry & Berry 2007).

Table 1.4: Model Results for both Policy Adoption & Ambition

	Policy Adoption ¹		Policy Ambition ²	
	Direct Coef. (Std. Error)	Conditional Coef. (Std. Error)	Direct Coef.(Std. Error)	Conditional Coef. (Std. Error)
Problem severity				
Deaths from disasters	-734727 (460892.3)	1086182 (474489.4)**	-406612.7 (145088.3)***	365106.4 (217675.2)*
Vulnerability				
Poverty rate	.7710997 (.4572591)*	1.297577 (.5582413)**	.0599142 (.1327461)	.1641693 (.138479)
Coastline miles	.0011975 (.0003867)***	.001431 (.0004631)***	.0004529 (.0000935)***	.0004922 (.0000929)***
Political factors				
Citizen ideology (liberal to conservative)	-.1555705 (.089543)*	-.2894779 (.1287961)**	-.0474539 (.0362087)	-.0779918 (.0360405)**
Government ideology (liberal to conservative)	.034583 (.0426904)	.1476601 (.0625351)**	.0079921 (.0141598)	.0504367 (.0184113)***
Interest Group Pressure				
Environmental Groups	56.19498 (1478.008)	2372.035 (1533.269)	3017.746 (622.4423)***	3148.765 (610.5334)***
Carbon Intensive Industry	-.5899644 (.3020395)*	-.5804474 (.3246915)*	-.3728336 (.076306)***	-.3747806 (.0743169)***
State Resources				
Median Income	.0002609 (.0001602)	.0003569 (.0001833)*	-.0000852 (.0000468)*	-.0000967 (.0000459)**
Civic Engagement- Urbanization	-.0158465 (.0911013)	-.0607259 (.1027124)	.0298272 (.0211203)	.0217673 (.0216014)
Policy Experience - Mitigation	8.815565 (3.26603)***	10.82546 (4.091057)***	.9642972 (.7776952)	1.367073 (.8017281)*
Horizontal Diffusion	5.798212 (2.870924)**	5.233646 (2.931795)	5.881069 (1.296379)***	4.936665 (1.260479)***
Conditional Effect				
Govt.Ideology * Problem Severity		-48709.51 (18093.26)***		-17701.26 (5383.419)***
Constant	-29.15783 (16.75886)*	-50.36319 (20.67169)**	3.903509 (5.457972)	1.678553 (5.364218)
N	296	296	296	296
Log likelihood	-47.14634	-43.86388	-536.13981	-531.54516
Wald χ^2	34.09	34.42	84.50	86.66
Prob χ^2	0.0004	0.0006	0.0000	0.0000

Note: ***, **, * indicate statistical significance at the 0.01, 0.05, and 0.10 percent levels, respectively.

¹ Policy Adoption is a logit model ² Policy Ambition is a negative binomial regression model

Citizen and state ideology have mixed outcomes. I find that policymakers respond to their electorate while setting policy agendas, but this influence is not consistent across my direct effects and conditional effects models. Statistically, this could be due to the conditional effect sucking up a lot of the variation of other variables. This result calls for further research.

My results on interest group pressure are unexpected. States with more environmentally active members are significantly more likely to prepare ambitious programs, but not influence SAP adoption. This implies that policymakers are partially responsive to pro-environmental pressures within their states and these subnational interest group pressures are only somewhat successful in mobilizing action. As predicted, the opposing group pressure from the carbon intensive industry does reduce the chances of states taking on SAPs. While this influence is modest in policy adoption (at the 0.10 level), once a state adopts the policies, the industry lobby is likely to pressure policymakers not to implement intensive goals. This may be understood as the carbon lobby pushing for more symbolic adoption of policies whereas the environmental groups support better strategies for addressing the impacts of climate change. This finding is indicative and deeper investigation is needed through case study analysis.

Results for policy experience and horizontal diffusion present interesting patterns. While I expected both predictors to enhance the likelihood that a state would adopt a SAP and also influence the number of goals identified within that SAP, the results indicate that experience with developing climate mitigation policy is more influential in adopting new SAPs, but this mitigation experience does not translate into more ambitious goals within a SAP. External pressure from neighboring states however, does boost the number of goals or ambitiousness of a state's SAP. When adopting SAPs, policymakers are more likely to maximize on their experience gained in adopting mitigation plans through knowledge gathered and networks built.

Yet it maybe that given that strategies for mitigation measures (reducing GHG emissions) are different than those for adaptation (building resilience), this experience is probably not sufficient to enhance the actual goals set in SAPs. However, as anticipated, when a state decides to adopt a policy, it may look to its neighbors through shared EPA regional offices to pool resources and information to overcome barriers of information to adaptation (Amundsen et al., 2010; Bierbaum et al., 2013; Biesbroek et al., 2013; Hamin, 2012), resulting in the preparation of more ambitious strategies.

In keeping with findings of the DOI theory, my study shows that policy ideas do spread among neighboring states. Interestingly, when I test this influence with more complex dependent variables like policy ambitiousness, I find interesting nuances in how this effect may play out. Neighboring states are more likely to increase the propensity of other states to set more adaptation goals and this in doing so, encourage preparing better adaptation policies. This finding is promising for researchers and policymakers involved with climate adaptation.

Conditional Effects: My interaction effects models tested the conditional relationship between government ideology and problem severity. As I expected, state governments are likely to respond to policy decisions based on the number of deaths caused by severe weather events in their jurisdiction.

The results for policy adoption show that at lower levels of deaths from disasters, a predominantly conservative government is not likely to adopt an SAP. However, as the intensity of environmental disasters increase and result in higher incidences of deaths, conservative government institutions are statistically more likely to respond with measures of policy adoption. This conditional effect is also prominent among liberal state governments. When the number of deaths from disasters increase, liberal governments are more likely to respond with adopting

policy measures. It is important to note that government ideology was not a statistical predictor in my direct models, and only shows a likely conditional effect on SAPs.

1.6. DISCUSSION AND CONCLUSION

Studies examining politics of climate adaptation among U.S. states are few. This chapter investigates the factors that predict the emergence and intensity of SAPs and the results deepen our understanding of this currently under-explored area. I find that broadly there are many commonalities between factors that predict climate mitigation and adaptation policy. Previous mitigation studies show the importance of state and citizen ideology and presence of carbon intensive industry and environmental groups. These predictors also matter for climate adaptation. In addition, given the high cost barriers to implementing adaptation measures, SAPs more likely influenced by the economic capacity of states and their geographic and human vulnerabilities.

Second, I find differences between predictors that influence policy adoption and policy ambitiousness. While state vulnerabilities and economic capacity matter in both cases, I find that states are more motivated to prepare ambitious SAPs when they face greater threats of climate impacts and pressures from environmental interest groups. On the other hand, citizen ideologies and previous mitigation policy experience are more influential in policy adoption. These findings shed light on the theoretical under-pinning's of the DOI theory, and the need for policy analysis using more complex dependent variables. Dependent variables that capture more detailed dimensions of policy adoption have the potential to capture finer information on predictors of importance.

Third, I explore conditional effects of state government ideologies and the severity of the problem. I find that while as an independent predictor government ideology did not have a strong

effect on SAPs, when examined from the conditional perspective, both conservative and liberal state institutions were more likely to respond to increasing problem severity by adopting adaptation strategies. These findings are interesting and advance our understanding both theoretically and substantively.

Lastly, regional diffusion matters in adaptation policy. Given that climate policy is still at its nascent stage, states within EPA regions tend to share information and resources among themselves and these regional actions impact a state's policy decisions. Overall, the results contribute to the understanding of what factors predict the emergence of adaptation policies among states, and when states might move towards preparing more ambitious goals and programs. The findings also advance DOI theory by testing more complex measures for a dependent variable along with conditional predictor effects. This study is among the few to examine the politics surrounding climate adaptation policies in the United States. The results are promising and encourage further analysis and investigation into subnational climate change activity.

CHAPTER 2

WHEN SIZE MATTERS: PREDICTORS OF ADAPTATION PLANNING IN SMALL, MEDIUM AND LARGE U.S. CITIES

“Despite the ‘global’ nature of the challenge, over the past two decades it has become increasingly apparent that cities and regions are critical places for addressing climate change.”

- Harriet Bulkeley, Cities and Subnational Governments (pp.464)

2.1. INTRODUCTION

By the year 2050, over seventy percent of the world’s population is expected to live in urban areas, intensifying the problem of cities and climate change (UNFPA, 2007). Urban areas are responsible for more than three-fourth global Greenhouse Gases (GHGs) making them geographic spaces with high emissions density (IPCC, 2007). At the same time, cities and municipalities host large concentration of infrastructure, economic activities and vulnerable populations that are at risk from sea level rise and extreme weather events, (Bulkeley, 2011). They are often located in environmentally sensitive areas that are expected to witness adverse impacts of climate change. Events such as Hurricane Katrina and Sandy are a reminder of the vulnerabilities of cities, even in the United States. Many of the largest cities in the country face threats such as fragile water supplies and are along the coasts which are expected to experience more severe flooding and sea level rise (World Bank, 2010).

With the lack of federal legislation, and in many cases state legislation to respond to climate change, cities and municipalities are taking action on their own initiative towards this global commons problem. Today, over 1060 mayors from all across the country (representing

approximately 30% of the national population) are formally signatories to the U.S. Conference of Mayors Climate Protection Agreement. While this agreement is primarily for reduction of greenhouse gas emissions (GHGs), it reflects growing commitment by cities to reducing the impacts of climate change.

Trends in adaptation at the local level have received relatively less attention than mitigation. Currently there are only 22 local governments¹¹ that have their own adaptation plan or a section within climate action plans (ICLEI 2016). Interestingly, 117 local governments have signed the *Compact of Mayors* agreement committing to concrete adaptation planning within three years and 174 mayors have signed the *Resilient Communities for America Agreement (RC4A)*. Resilience is viewed by many scholars as a more holistic approach to addressing the vulnerability of communities and ecosystems to climate change (Adger, 2006; Gallopín, 2006). The RC4A spearheads the “Paths to resilience” measures that reduce the vulnerability of a community through a broad array of initiatives such as climate preparedness, infrastructure renewal, enhancing energy security and economic prosperity (RC4A 2014).

Even with federal and state government action, the role of cities will remain pertinent to developing policy solutions for climate change. Local governments have jurisdiction over various adaptation policy sectors such as transportation, drinking water, land use and infrastructure which are more likely to be tailored to the local climate impacts. Instead of a ‘laundry-list of actions’ recommended in large scale plans for the federal or state governments, cities are in a unique position to customize their policy strategies to the specific challenges and opportunities faced by the local community (Boswell et al., 2012). With proximity to the policy

¹¹ These number is excluding County-level government adaptation plans and action

problem, they can also influence partnerships among the private sector and local community for successful implementation of different programs (Engel & Orbach, 2008).

Recognizing this, the importance of local governments in implementing sustainable development was emphasized more than two decades ago in prominent reports such as the 1987 Brundtland Report and the first Earth Summit in 1992. As part of the UN's 1992 report, the Agenda 21 resolutions in particular highlighted local authorities' role in implementing national and international policies, including climate change mitigation and adaptation (United Nations, 1993). Yet there appears to be lack of preparedness for climate change adaptation among American cities.

In the US, fewer than 250 local governments out of more than 30,000 places have made a commitment for action on climate adaption. While this is a small number of governments, research and experience from other countries suggests that this number will grow. Therefore, it is critical to develop a better understanding of why some local governments engage in adaption planning while others do not. This insight will help government officials, interest groups and the public by identifying potential areas of focus to augment planning for adaptation.

Currently cities adopting adaptation policy vary substantially in population size with small as well as large cities building climate resilience. Previous research suggests that smaller cities face greater challenges with gathering political will and fiscal capacity, and have been less likely to adopt sustainable policies (Lubell, Feiock, & Handy, 2009). The pattern for adaptation is different from other policy areas. This make cities an interesting case of "laboratories of democracy" to understand the reasons for variation among places planning for climate adaptation.

In this chapter, I explore the factors that predict the variation in climate adaptation planning among local governments of different sizes. I ask the question – why are some cities adopting climate adaptation action while others are not? What factors predict the emergence of city action, and do these factors vary across cities of different sizes – mainly small, medium and large cities? I augment the Diffusion of Innovation (DOI) theory with insights from urban policy research to better understand how institutional characteristics such as mayor versus council-manager systems, interest group pressures, fiscal capacity and pressures from the state government influence city policy adoption (Berry, 1994; Berry & Berry, 2007; Feiock, Francis, & Kassekert, 2010).

The DOI theory is almost exclusively applied to states or countries (some exceptions see (Godwin & Schroedel, 2000; Krause, 2011; Skeer et al., 2004), and merits greater application at the local level. Scholarship on urban politics finds that municipalities have been particularly influenced by business interests and more inclined to act on preferences of industry lobbyists (Peterson 2012; Stone 1980). Local governments have also been likely to engage community and non-profit organizations to implement policy initiatives (Boswell et al., 2012). These collaborative relationships expose urban governments to popular public support and influence their policy choices, especially among the local authorities following the mayor-council form of government (Bae & Feiock, 2013). I also apply DOI theory to a relatively untested area of urban politics by examining factors across a range of small, medium and large cities.

I use a multilevel model to structurally capture how cities are nested within political, economic and policy structure of states. Applying a cross-sectional analysis for the year 2015, I test the DOI theory on a sample of adopter-cities matched with non-adopter cities. Given the rarity of the event of interest, adaptation policy adoption, a random matching method is used.

Separate models are run for all cities taken together, and then subgroups of cities based on population size of small, medium and large places. I find that state level characteristics and policy experience do not influence city's decision to plan for adaptation. Cities are more likely to respond to internal factors like social vulnerability, presence of carbon intensive industry and the structure of the government.

Further, I find that smaller cities respond differently from medium and larger cities. Smaller cities are more likely to be influenced by interest group politics with the presence of competing pressures from environmental groups and the industry lobby. It is encouraging that among these opposing factors, a greater presence of environmental interests in smaller cities can help policymakers overcome industry resistance and adopt plans. Larger cities are more likely to be influenced by public opinion than the vulnerabilities of the community. These preliminary findings elicit deeper investigation into the urban politics surrounding climate adaptation planning. In the chapter I first present a background to climate change adaptation and cities in the United States. I then provide the theoretical framework, and describe my data and methods. Next, I present my results and discussion and conclude the paper with avenues for future research.

2.2. BACKGROUND ON CITIES AND CLIMATE ADAPTATION

Despite global efforts to reduce GHG emissions, scientists have projected that there will be unavoidable consequences of climate change that will require some level of adaptation. Planning for these risks poses many challenges, including the uncertainty in predicting the frequency and magnitude of climate impacts. Over the past three decades global climate models

have been evolving to capture the complexity of the problem, however translating these models to the local scale adds another dimension of uncertainty (IPCC, 2014).

Adaptation planning requires a clearer understanding of the projected rate and magnitude of risks. Against these risks, an evaluation of the vulnerability and capacity of the local community to withstand changes is needed. Based on these assessments, holistic adaptation strategies can be identified, prioritized and implemented (Boswell et al., 2012). Over the years cities have developed diverse adaptation strategies including emergency preparedness mechanisms, ecosystem protection policies, land use changes, health initiatives and infrastructure design (Shi et al., 2015). For example, Ann Arbor, MI has experienced nearly 25% more precipitation in the last 30 years (1981-2010) in comparison to the preceding thirty years (1951-1980). To respond to this, city officials are developing ‘Green Streets’ to increase natural infrastructure for better infiltration on streets and build resilience of the storm-water system of the city’s capacity (RC4A, 2016).

Similarly, Washington, DC has taken initiatives to ameliorate the increase in heat waves by encouraging ‘green roofs’ and creating tree canopies that cool the city, reduce energy use and slow storm-water runoff (RC4A, 2016). Coastal cities like Miami, FL have made approximately \$10 million dollar investment to improve the drainage system and flood mitigation projects to prepare for more frequent and severe storms and sea-level rise (RC4A, 2016). Some cities have included adaptation planning within Climate Action Plans (CAPs - primarily focus on reducing GHGs), while others have integrated climate change in local hazard mitigation plans or prepared free-standing adaptation plans (Boswell et al., 2012).

Labeling Climate Adaptation: Defining the boundary of adaptation policy can be challenging given that many public policies can directly or indirectly reduce vulnerabilities and

increase resilience to the negative impacts from climate change. Currently there is no consensus among scholars on what constitutes an adaptation policy. Some argue that for adaptation to be effective it must be integrated into different sectors, often termed as ‘mainstreaming adaptation’, and cannot be made on a ‘standalone’ basis (Biesbroek et al., 2010; Henstra, 2015; Tompkins et al., 2010). This approach has advantages like speed of strategy adoption by by-passing the process of the uptake of a new plan to directly changes within an existing policy (Hamin, 2012). Many scholars studying sustainability policies have utilized this approach and examined plans that directly and indirectly address the issue. Eg. Berke & Conroy (2000) evaluate 30 comprehensive plans, some which are specifically prepared for sustainable development, and some that have indirect sustainability benefits.

However the case of climate change, and developing policies and programs to insulate communities from the negative consequences of climate change, is different from general sustainable development policies, and the explicit labeling is beneficial. Dupuis & Biesbroek (2013) make a clear the distinction between ‘contributive’ policies – those that are not designed for climate adaptation but may have overlapping benefits; and ‘concrete’ policies that are explicitly created to plan for climate change. They propose focusing on the policies specifically labeled to build resilience and promote adaptation in the face of climate change because “*only the policy activities that prove to be highly intentional and sufficiently substantial should be defined as adaptation policy*” (pp.1481).

This research is focuses on local governments that have specifically committed themselves to promoting adaptation and resilience in the face of climate change. While there are likely climate adaption co-benefits to many obliquely labeled policies that cities can adopt, it is also important to understand the factors that shape concrete adaption & resilience policies.

Policies labeled as adaptation have a specific intentionality underpinning them, and are important to examine in their own right.

Narrowing the study focus to explicitly labeled adaptation policies has some advantages and does not diminish the usefulness of studying co-benefit policies. For example, climate adaptation overlaps with natural hazards mitigation strategies. Yet there is a need to differentiate between the two. Hazards mitigation does not include overarching strategies like ecosystem changes and is inadequate in capturing future risks and changes that stem from climate change (Boswell et al., 2012). The nature of the problem of climate change necessitates both – planning for cross-sectoral strategies and incorporating future risks to build long-term resilience. Political commitments and policies to build resilience that do not explicitly include projections of climate risk and climate uncertainties are insufficient in preparing for climate change. For these reasons, my study focuses on resilience commitment that is explicitly labeled climate adaptation.

Previous Adaptation Research: Despite financial and human capital constraints, local governments may be in a strong position to pursue climate adaptation and resilience. Not only are local governments more likely to successfully engage that public and understand local norms, but local control over land use and building practices can be an important component underpinning climate adaptation and community resilience.

Scholarship on adaptation planning at the local level has primarily been qualitative in nature. The first wave of studies conceptualized what constituted adaptation (Smith et al., 2000; Smith et al., 2009; UNDP, 2005) and differentiated between vulnerability, adaptive capacity and adaptation. These debates resulted in the development of various frameworks to analyze factors that support or constrain adaptation processes (André, 2013). The second generation of adaptation research applied these frameworks to qualitatively assess actual policies (document

analysis) and complimented them with interviews and small-N case studies of cities implementing these plans (Moser & Ekstrom, 2010; Shi et al., 2015).

They find that currently adaptation plans are incremental changes pursuing low-regret strategies and co-benefits (Bierbaum et al., 2013; Tang et al., 2010; Wang, 2013b) and primarily reactive to extreme weather events (Amundsen et al., 2010) . For instance, King County, WA has been declared a federal flood disaster 12 times since 1990, and as a reaction to on-going threats, has completed three flood protection infrastructure projects and helped relocate chronically flooded homes (RC4A, 2016). Interviews and surveys with key government officials reveal barriers to adaptation planning; frequently local institutions lack the knowledge, expertise, and resources to develop or implement strategies (Biesbroek et al., 2013; Carlson & McCormick, 2015).

Differentiating Across City Size: Larger cities with higher concentration of people, transportation and infrastructure, generally tend to be higher emitters of GHG emissions. Previous studies on climate mitigation have primarily focused on cities with population greater than 25,000 (E.g. (Bae & Feiock, 2013; Krause, 2011; Sharp, Daley, & Lynch, 2011) (to name a few). While these studies are important, they do not include an important segment of smaller cities in suburban areas. Suburban areas with populations less than 25,000 people host more than half the population of the United States (U.S. Census Bureau, 2010), making them important entities for consideration.

Irrespective of size, all cities and metropolitan areas have the authority to develop policies surrounding issues such as land use, economic development, infrastructure and environmental protection. However, with differences in size we often see variation in resources and capacity of cities. Smaller cities tend to lack the political will, fiscal capacity and have

poorer understanding of the problem (Carter & Culp, 2010). They may also respond differently to interest group pressures (Lubell et al., 2009).

Recognizing the need for closer examination, a small-N study by (Homsy & Warner, 2015) finds that smaller cities are better able to frame the issue of climate change mitigation to the local population and offers greater opportunities for policy adoption. Smaller places also allow for more collaboration and coordination within a federalist system. While we see the importance of testing predictors among different cities in mitigation studies, such work is still missing in climate adaptation. This leads to an incomplete understanding of climate adaptation policy decision-making within local governments. In this study I examine factors that predict the emergence of policies among cities as a whole (all cities) as well as explore differences among small, medium and large cities (also see Table 2.1 with city descriptions).¹²

Research Gap: These findings are valuable and have contributed to the initial understanding of adaptation planning. However, being limited in their scope, the findings are not generalizable. There is a need to perform a national level local government assessment of factors that predict the emergence of adaptation planning and commitment. Large-N studies have been conducted for climate mitigation pointing to factors like climate stress of being close to the coastline, political ideology of citizens, local government structure and fiscal capacity of a city impacting the likelihood of policy adoption (Krause, 2011; Zahran et al., 2008). However there are noteworthy differences between characteristics of mitigation and adaptation policies.

Adaptation policies have relatively greater private benefits which may increase their likelihood

¹² Population criteria of small, medium and large cities mimic the broader practice of city stratification used by the U.S. Census Bureau. Small Cities (Population less than 25,000), Medium Cities (Population between 25,000 and 100,000), and Large Cities (Population more than 100,000)

of adoption (Niles & Lubell, 2012), thereby requiring a separate analysis of the politics surrounding it.

Table 2.1: Number of Cities with Adaption Planning in a State

State	All Cities	Small Cities	Medium Cities	Large Cities	State	All Cities	Small Cities	Medium Cities	Large Cities
Alabama	3	1	0	2	Montana	1	0	1	0
Alaska	2	1	0	1	Nebraska	0	0	0	0
Arizona	5	1	0	4	Nevada	1	0	0	1
Arkansas	0	0	0	0	New Hampshire	0	0	0	0
California	45	9	21	15	New Jersey	1	0	1	0
Colorado	8	4	1	3	New Mexico	4	2	2	0
Connecticut	2	0	0	2	New York	9	2	5	2
Delaware	0	0	0	0	North Carolina	6	1	3	2
Florida	27	7	14	6	North Dakota	0	0	0	0
Georgia	4	2	0	2	Ohio	6	1	1	4
Hawaii	0	0	0	0	Oklahoma	1	0	0	1
Idaho	1	1	0	0	Oregon	4	0	2	2
Illinois	6	1	4	1	Pennsylvania	6	4	0	2
Indiana	3	1	2	0	Rhode Island	1	0	0	1
Iowa	5	1	3	1	South Carolina	2	1	0	1
Kansas	3	3	0	0	South Dakota	0	0	0	0
Kentucky	1	1	0	0	Tennessee	5	2	0	3
Louisiana	2	1	0	1	Texas	10	3	3	4
Maine	1	0	1	0	Utah	2	1	0	1
Maryland	8	5	2	1	Vermont	2	1	1	0
Massachusetts	8	2	5	1	Virginia	7	0	3	4
Michigan	8	1	4	3	Washington	8	1	4	3
Minnesota	4	1	0	3	West Virginia	0	0	0	0
Mississippi	4	3	0	1	Wisconsin	5	2	1	2
Missouri	4	1	1	2	Wyoming	0	0	0	0

We know little about the reasons for variation in action among cities. Why do some cities engage in and pursue climate adaption & resilience policies, while others do not? What factors

predict the emergence of this commitment to foster a community's adaptive capacity, and do these predictors have varying influences on cities of different sizes? Building on previous work, my chapter explores these questions by testing the influence of various political, socio-economic, and environmental factors within a city on the likelihood of policy commitment.

2.3. THEORY AND RESEARCH HYPOTHESIS

The Diffusion of Innovation (DOI) theory describes policy innovation as the act of adopting a 'new' policy or program, often in the context of new to the government adopting it (Walker, 1969). This theory is well suited to understand why some governments adopt policy while others do not (Berry & Berry, 1990, 2007). While DOI has mainly been applied to state level empirical studies, there is growing research that explores local adoption of regulatory policies such as gun control (Godwin & Schroedel, 2000), anti-smoking legislation (Skeer et al., 2004) and climate mitigation (Krause, 2011).

Initially the DOI theory proposed that policy innovation occurred based on either internal characteristics (Walker, 1969) or solely due to external influences (Gray, 1973). Recent scholarship proposes that both explanations - characteristics within a government and external pressures can simultaneously contribute to policy making (Berry & Berry, 1990, 2007; Mintrom & Vergari, 1998). Urban politics scholars point to local decision-making being tied more closely to interest group pressures, fiscal capacities, community characteristics and institutional structure (Feiock et al., 2010).

These internal characteristics are expected to have differing influence based on city size. Larger cities are more likely to have sustainable development commitments to build adaptive capacity than smaller cities. Less-developed and smaller cities face various resource challenges

and often lack the capacity to invest in administrative resources for planning (Lubell et al., 2009). In addition, cities also look to their neighbors and are influenced by state government actions and incentives (Hanna, 2005). Each of these factors is explained in detail below.

Internal Determinants: Internal characteristics of a city like its political, social, economic and environmental conditions can function as motivators, obstacles or resources for policy adoption (Feiock & West, 1993; Lubell et al., 2009; Walker, 1969).

Severity of the problem can be an important motivator for government action. Scientific evidence for climate change points to an increase in many weather-related impacts which are expected to damage property, ecosystems and human lives. Recent research shows that an increased risk of extreme weather events tends to encourage governments to take adaptation measures (Berkhout et al., 2006; Naess et al., 2011).

Hypothesis 1: Cities experiencing more severe extreme weather impacts will be more likely to commit to taking action for adaptation. Moreover, I expect that larger cities with greater concentration of people, industries and infrastructure will face greater losses and be more likely to commit than smaller cities.

While environmental disasters may hit a location, the impacts from a disaster are not uniformly distributed. In other words, within a community, some neighborhoods will be more vulnerable than others. Low-income individuals and communities, socially isolated individuals and individuals who live in deteriorated or decaying infrastructure face higher risk from climate-related disasters. Such individuals lack the capacity to bounce back after the disaster and therefore face dire circumstances in the aftermath (Adger et al., 2006). This pattern is also

evident across natural disasters, leading researchers to investigate ways to measure vulnerabilities of communities. Income, education, race & class and employment opportunities largely contribute to the coping capacities of communities and individuals (Battersby, Mitchell & Cutter, 2011).

Hypothesis 2: Cities with greater percent of population vulnerable to climate impacts are more likely to build resilience and adopt policies. Similarly, smaller cities are likely to have lower coping capacities and I expect them to be more likely than larger cities to respond to social vulnerabilities.

Public opinion and citizen ideology also shape the types of policies formulated in a city. Within a federalist system like the US, local governments are lowest in hierarchy and tend to be easier to access by citizens. The nature of local politics suggests that not only would citizens have easier access to their local officials to express their opinions, but also that local officials should be highly aware, and indeed even share many if not all of the local preferences (Sharp, 2012).

The perception of risk, proximity to the problem, knowledge and understanding of the issue, as well as social attitudes can be a significant driver for policy adoption (Tierney et al., 2001). For climate change, this is particularly imperative given the contentious politics surrounding the issue. Public awareness and perception of the climate risks affect the willingness to prepare mitigation and adaptation policies (Carlson & McCormick, 2015). Studies find that when the public are more in agreement with the dangers of climate change (pro-climate change)

and the need for policy action, policy-makers respond to such opinion and adopt strategies (Brulle et al., 2012).

Hypothesis 3A: Public opinion will directly shape the likelihood that a local government develops a climate adaptation plan. Cities with a greater proportion of citizens that believe in and are concerned with climate change are more likely to commit to building local adaptive capacity and resilience to climate change. I expect this influence to be relatively equal across city size.

Previous research suggests that the configuration of a city's executive branch in its local institution shape the outcome of policies (Feiock et al., 2010; Ramírez, 2009; Sharp et al., 2011). In general, cities can be grouped into two institutional structures, mainly council-manager or commission governments and mayor-council governments. Mayor-council cities are based on separation of power with the executive authority with the mayor and legislative branch with the city council. The council-manager governments have a single branch with consolidated power in the city council, and the council hires a professional manager for city operations (Bae & Feiock, 2013).

Mayor-council forms of government tend to be more politicized, particularly compared to the council-manager counterparts. Mayors tend to pursue more goals & policies that provide political advantage and increase their ability to be re-elected. In comparison, council-manager forms of government are often more insulated from local politics and with a professional manager guided by professional norms. Given that climate change is a controversial issue, council-manager governments are more likely to encourage commitments that may require a

longer time horizons like those required to build adaptive capacity to climate change, as well as be less affected by the politics surrounding the issue (Clingermayer & Feiock, 2014). In addition, since the council-manager systems hire professional managers for the day to day operations of the city (Bae & Feiock, 2013), they may be in a stronger position to understand the technical and scientific aspects of local climate change, and protected from the political debates, pursue climate adaptation planning.

Hypothesis 3B: Cities with council-manager forms of government are more likely to commit to build adaptive capacity and facilitate resilience, than mayor-council governments. I expect this influence to be relatively equal across city size.

Urban politics often frames local politicians as suppliers of public goods and services, responding to the demands of both interest groups and general demands within the local jurisdiction. Through a pluralist framework, these interest groups compete amongst each other for the policy outcomes of their preference. Local governments respond to these pressures and meet the demands of those interests that yield maximum resources to the politicians (Lubell et al., 2009). Often, development and business growth interests have substantial influence in local politics. Comparatively, public interests are more diffused and this leads to unequal power among the interest groups (Stone 1980) that results in a stratification of power within a local community. Business (organized) groups generally have higher levels of influence, while the public – a more diffuse interest group pressure, if unified at all – tends to have influence within lower levels (Stone 1980). This pattern favors business interests and accommodates priorities of

manufacturing and industry sectors in policymaking (Lubell et al., 2009; Peterson 1995; Stone 1980).

Within this context of interest group pressures, studies find that a stronger presence of environmental groups can lead to more participation of cities in environmental protection and sustainability programs (Portney, 2009). And this trend is also visible for adopting climate mitigation policies (Zahran et al., 2008). Climate politics, however, is likely to generate both supportive and oppositional interest groups vying for influence.

This seems true for mitigation policies that seek to limit emissions. Carbon intensive industries such as manufacturing firms tend to resist policies that aim to reduce GHG emissions due to increased costs or expected change of practices (Krause, 2011; Zahran et al., 2008). It is not clear if this pattern will hold for adaptation, or if a commitment to adaptation will be far less controversial given that it may not entail behavior change on the part of the emitters. With regard to city size, smaller cities have relatively more avenues for interest groups to negotiate and assert their influence. Bigger cities tend to have larger bureaucratic hurdles and are relatively less permeable (Lubell et al., 2009).

Hypothesis 4A: Cities with greater presence of environmental groups are more likely to engage in building resilience for climate change. Additionally, I expect interest group pressures to be more impactful among smaller cities.

Hypothesis 4B: Cities with larger presence of carbon intensive industries receive more oppositional pressures and are less likely to build resilience, and this pressure is expected to be higher for smaller cities.

Planning for adaptation entails additional expenditure and resources. Urban scholars suggest that larger cities have greater resources to devote for administrative expenses incurred in planning than smaller ones (Burby & May, 1998). The need for resources is exasperated in the case of climate adaptation. A key challenge for climate adaptation is the relatively high cost of implementing strategies (Bierbaum et al., 2013; Biesbroek et al., 2013). Governments with weak fiscal health are less likely to adopt new policies and programs (Lowry, 2005) and the availability of resources can pose as a barrier. This is especially true for smaller cities that are more likely to lack the fiscal capacity and resources required to build climate resilience (Carter & Culp, 2010; Lubell et al., 2009).

Hypothesis 5: Cities with greater economic resources and capacity are more likely to pursue a commitment to adaptation. Moreover, I expect that larger cities having relatively better resource capacities than smaller cities are more likely to participate in adaptation.

External Pressure: In the federalist system of the US, the top-down pressure is more constrained between local and state governments, than with state and federal authorities. This makes urban politics an interesting case to test the DOI theory. While the basic insights of the theory will hold, the variation in the unit of analysis (local governments) tests external pressure under a more constrained relationship than the typical case of states.

City governments can experience external pressures such as policy action by neighboring cities (horizontal diffusion) and/or impact of actions by state and federal governments (vertical diffusion).

Horizontal Diffusion: The DOI theory provides two primary explanations to describe the spread of policy ideas from one city to another. First, cities may look to their geographic neighbors (Grossback, 2004) to test the success or failure of new policies and select those that they perceive as beneficial to them (social learning model) (Mooney & Lee, 1995). For example, Chicago, IL has been a leader among city adaptation policies, both in terms of early plan adoption and intensity of strategies to build resilience. The Chicago Climate Action Plan-2008 became a benchmark for other cities to follow through (RC4A, 2016). In fact organizations like ICELI provide a platform for cities and local governments to come together to share information and experiences on adaptation planning.

Second, cities might compete with each other to gain an economic advantage for their jurisdiction and emulate policy ideas adopted by their neighbors (economic competition) (Berry & Berry, 2007). To illustrate, the federal and some state governments provide resources to help governments plan and implement resilience strategies. Taking the health sector as an example, the Center for Disease Control and Prevention (CDC) has developed a framework on Building Resilience Against Climate Effects (BRACE) and allocated funds to pilot-test this framework among sixteen states and two cities (CDC, 2010). Funds such as these are limited and city governments are likely to compete to gain an economic advantage.

The diffusion of ideas is more likely to be prominent among smaller cities. Planners in smaller cities face a greater challenge with lack of knowledge about the problem and the technical know-how for solutions (Lubell et al., 2009; Svara, 2011). Small city governments that want to build resilience would tend to learn from and build networks with neighboring governments to enhance their strategies and initiatives.

Hypothesis 6: Cities with neighbors participating in climate adaptation and resilience are more likely to make commitments for adaptation action (horizontal diffusion). Furthermore, smaller cities are more likely to imitate policies adopted by their neighbors.

Vertical Diffusion: Local climate adaptation among cities also provides a good background to test vertical diffusion or influence of state and federal policies at the local level (Shipan & Volden, 2006). With the void in federal adaptation policy, I explore vertical diffusion mainly in the context of state action. In the case of cities, there are competing hypothesis for vertical diffusion. First, action at state level can lead to increased diffusion or “snowball effect” at lower levels of government (Shipan & Volden, 2006). Alternatively, a “pressure valve effect” maybe observed with reduced probability of local action under the assumption that the states are already undertaking sufficient action (Shipan & Volden, 2006). Within this context, city size is likely to matter. Smaller cities may lack the resources or technical capacity necessary to pursue a commitment to climate adaption (Carter & Culp, 2010; Homsy & Warner, 2015). Resource limitations may encourage some small cities to seek out support from state governments or free-ride on action taken by higher levels of authority.

Top-down pressures from the state can manifest in various forms and in this study I focus on three main – state-level policy experience, government ideology and strength of the carbon industry. More liberal governments are more likely to support policies for climate change (Zahran et al., 2008; Zia, 2013). We also know that oppositional pressures through the presence of larger carbon intensive industries at the state level can potentially filter down to the local level as well (Krause, 2011).

Hypothesis 7a: Local governments within states that have adaptation plans, have democratic government institutions and smaller carbon intensive industries are more likely to results in a trickle-down effect for city level action (positive effect); and this effect is expected to be more pronounced among smaller cities.

Hypothesis 7b: Conversely, local governments within adaptation proactive states – policy action, democratic institutions and smaller carbon intensive industries, will reduce their city-level initiatives under the assumption that sufficient action is already underway (negative effect). This influence is more likely among smaller cities than larger ones.

2.4. DATA & METHODS

DEPENDENT VARIABLE: While limited in number, cities have made commitments to build adaptive capacity to the impacts of climate change. Some cities, such as New York (NY), Denver (CO) and Austin (TX) have developed stand-alone policies for climate adaptation. Other cities have signaled a commitment to building adaptive capacity by becoming signatories to public agreements that promote the city’s commitment to build climate resilience. Two of the main global and national programs of prominence in the country are – the Compact of Mayors and the Resilient Communities for America (RC4A) Campaign. These programs are primarily for climate adaptation and differ from mitigation priorities that are expressed in other programs like the U.S. Council of Mayors, Cities for Climate Protection and C40 Climate Leadership.

Resilient Communities for America Campaign brings together local elected officials to, in the face of climate change, create more resilient cities, towns and counties. The program facilitates local communities in their efforts to build resilience in four priority areas: (1)

preparing for extreme weather changes; (2) expanding renewable and energy security; (3) strengthening infrastructure; and (4) strengthening local economies. The aim of this multi-year program is to gain leadership commitment and work in close collaboration with organizations that provide access to helpful and relevant resources and tools. Leading organizations like ICELI-Local Governments for Sustainability, the National League of Cities, the U.S. Green Building Council and the World Wildlife Fund together run the RC4A program. They provide their members support by sharing best practices on planning and implementing resilience-enhancing activities (RC4A, 2016).

On similar lines, the Compact of Mayors is a global initiative that requires cities to make a three year commitment to perform activities for both mitigation and adaptation to climate change. In order to be awarded the official “Commitment” badge, in the context of adaptation, a city is required to identify climate risks, conduct a climate change vulnerability assessment, and establish an action plan to build reliance (Compact of Mayors, 2016). These activities under the Commitment are aimed to support cities in planning for climate adaptation by providing a guiding framework of steps that will strengthen the quality of plans and their implementation.

For the purpose of this study, cities participating in these two programs, as well as those with stand-alone policies are considered as having a commitment to fostering climate adaption and resilient communities. With my focus on city level governments, adaptation initiatives by counties are not included in the study. A total of 235 cities are identified as having a public commitment to building climate resilient communities and enhance climate adaption. The dependent variable for the study is dichotomous to represent a city’s commitment (or lack thereof) to climate adaption/resilience.

Sample: The United States has over 30,000 general purpose local governments, with nearly 19,500 municipal governments and 16,500 townships (National League of Cities, 2016). Of this total, as mentioned above, only 235 local governments have made concrete commitments for climate adaptation and resilience activities. Given the infrequency of occurrence of cities of interest (policy adopters), this study lends itself to “rare events” and a sample of the entire universe of cities will highly underestimate the probability of the dependent variable (King & Zeng, 2001). Rare events have theoretical and substantive significance and it is not uncommon for researchers to focus on events such as the number of suicides, divorces and deaths within a population, or the occurrence of wars (Lacy, 1997). Studying rare-events requires more efficient research designs to construct unbiased samples (King & Zeng, 2001).

Table 2.2: Description of Cities in Study Sample

CITIES FOR THE STUDY		
City Size*	Population Criteria*	N
Small Cities	Less than 25,000	136 (68 policy adopters)
Medium Cities	Between 25,000 to 100,000	170 (85 policy adopters)
Large Cities	More than 100,000	164 (82 policy adopters)
Total		470 (235 policy adopters)

NOTE: *Population criteria of small, medium and large cities mimic the broader practice of city stratification used by the U.S. Census Bureau.

My sample is created by first identifying the adopter cities – those with stand-alone adaptation plans and members of RC4A and the Compact of Mayors. I then add census information city population to help group the cities into small, medium and large cities (populations <25,000; 25,000 – 100,000; and >100,000 respectively). This is followed by a random matching process of cities that have adopted policies with cities that have not (King, Keohane, & Verba, 1994), using the criteria of ‘*city-size within a state*’. For example, Boston in Massachusetts with population over 100,000 people is a city with a commitment to building

climate adaption. With this city identified, I then assemble a list of similarly sized cities in the same state, and randomly sample from that list to select a comparison case for this dataset.

Through this process, Springfield, MA was included in the data set to represent a similarly sized city that *has not* pursued a public commitment to enhancing its climate resilience. Through this process, each of the 235 cities are randomly matched, making the study sample N=470 (Refer Table 2.2).

Table 2.3: Variable Description of City (Level-1) and State (Level-2) Predictors

Concept	Variable Operation	Sign	Data Source
<i>Dependent Variable</i>			
Policy Adoption	Dichotomous variable – city with plans + resilience signatories + sign Compact of Mayors coded as 1, cities with no plans or in-progress coded 0		Resilient Cities for America (RC4A), ICLEI, & Compact of Mayors (2015)
<i>Independent Variables (Lagged by 1 year)</i>			
Problem severity			
Climate Change Impacts	Count of number of extreme weather related events in a county aggregated over a period of five years (no need for average)	+	National Oceanic and Atmospheric Administration (NOAA) (2010-2014)
Social Vulnerability	Social Vulnerability Index = [% low-income + % minority + % less than high school education + % linguistic isolation + % individuals under age 5 + % individuals over age 65] / 6 calculated for a city. This formula is based on Environmental Protection Agency – Environmental Justice Indicators (EJSCREEN)	+	American Community Survey (ACS) five-year summary, U.S. Census Bureau (2014)

Concept	Variable Operation	Sign	Data Source
Political Factors			
Public Opinion	Index created for percentage of population with public opinion supporting climate change on 7 variables – global warming is caused by humans, worried about impacts, harm them personally, harm people in the U.S., harm future generations, and is happening now and within next 10 years; calculated at county level	+	Yale Program on Climate Change Communication (2015)
Govt. Ideology	Dichotomous variable coded as 1 if the city has a mayor-council form of government and 0 if the city has a city manager-council form of government		ICMA and Hand-Coded through internet searches
Interest Group Pressures			
Environmental Organizations	Count of environmental nonprofits in a county	+	National Center for Charitable Statistics (NCCS), Core Files, (2013)
Carbon Intensive Industry	Percentage of jobs that are directly connected with high carbon emitting industries – mining, utilities, construction and manufacturing sector of a city.	-	American Community Survey (ACS) five-year summary, U.S. Census Bureau (2014)
City Resources			
Fiscal Capacity	Median Income of a city	+	American Community Survey (ACS) five-year summary, U.S. Census Bureau (2014)
Population	Count of number of individuals in a city		American Community Survey (ACS) five-year summary, U.S. Census Bureau (2014)

Concept	Variable Operation	Sign	Data Source
Diffusion			
Horizontal: Participating Neighbors	Total number of cities within a state with mitigation policies	+	Calculated using city policy adopters – ICLEI, RC4A, Compact of Mayors
Vertical: State Factors	Multilevel Model Indicators (Level-2) 1) <i>State Adaptation Experience: Climate Adaptation Plan</i> (coded 0=no policy, 1=policy adopted, 1=policy in-progress) 2) <i>Government Ideology (2013): Ideology of state's elected officials across legislature, senate, and governors on a liberal to conservative continuum</i> 3) <i>Carbon Intensive Industry: Percent of carbon intensive industry contribution to total state GDP from 4 main sectors - Mining, Utilities, Construction, and Manufacturing</i>	+ / -	1) Georgetown Climate Center (2014) 2) Berry, Ringquist, Fording, and Hansen 1998 (2013) 3) U.S. Bureau of Economic Analysis (2013)

INDEPENDENT VARIABLES: Based on the DOI theory, several independent variables representing internal determinants and external pressure on city's decision-making are used in this analysis. These are divided into two levels of analysis – Level-1 is the 470 cities, and Level-2 is the 50 states.¹³

¹³ There are 9 states with no cities undertaking adaptation planning – Arkansas, Delaware, Hawaii, Nebraska, New Hampshire, North Dakota, South Dakota, West Virginia and Wyoming.

A. City Variables (Level-1)

Problem Severity: Cities are likely to build resilience to local impacts of climate change such as extreme weather events. I measure the intensity of the problem through the frequency of extreme weather events in a county. The National Oceanic and Atmospheric Administration (NOAA) maintains long term data on over 30 different types of weather related incidents such as droughts, floods, heat waves, wild fires and storms. I aggregate these events over a period of five years to create a count on the incidents of extreme events for a location. Previous studies have used number of environmental disasters to capture the extent of threat from potential climate impacts (Battersby et al., 2011; Borden & Cutter, 2008; Zahran et al., 2008).

Social Vulnerability: Vulnerability to climate change is contingent on the capacity of individuals within their communities to cope with environment disaster (Adger, 2006). Assessing vulnerabilities is a way to identify the consequences from, and risk to climate impacts, and is often calculated based on various socio-economic characteristics of a community. I use the EPA's Environmental Justice framework as a guideline to create an index for social vulnerability. EPA's EJSCREEN provides a county level social vulnerability index calculated through key characteristics of a disadvantaged population (EPA, 2015). The index aggregates six factors - the percent of low income households, race and ethnicity based minority population, people with less than high school education, linguistic isolation, children under the age 5 and adults over the age 64. Following EPA's methods, I replicate this index using data from the American Community Survey for places/cities within my sample.

Political Factors: Citizens opinion on climate change is a good indicator of the preferences of the electorate within a jurisdiction. Whether the mass public supports climate change and perceives the need for government action to ameliorate the problem, can give a good indication of the average ideological preference of the mass public on the issue. Public opinion in favor of climate adaptation is a key driver for local governments to build climate ready communities.

The Yale Program on Climate Change Communication provides data on state and local public opinion on climate change. In 2015 they conducted a state and local government climate change opinion study with various questions that capture people's views on the knowledge, risk and perceptions of climate change (Howe et al., 2015). While most of my other independent variables are lagged by one year or more relative to the dependent variable, this survey is conducted in 2015 – the year of the dependent variable in analysis. Since we do not expect high fluctuations in public opinion over a period of one year, and given the limitation that the survey is only conducted once and for the year 2015, I include this measure of public opinion on climate change without the lag of one year.

From the survey, I select responses on seven relevant questions - whether global warming is caused by human activities; people were worried about global warming; it will harm them personally; it will harm people in the U.S., it will harm future generations; and whether global warming will start harming people in the U.S. now and within the next 10 years. These questions aim to capture a holistic attitude of people on climate change. Since these variables are tapping into the same concept (opinion on climate change), for parsimony, I collapse them into a single index (with a Cronbach Alpha of 0.971). The final measure is a score for the percentage of the population in a county that supports climate change.

The structure of the city government is also an important political factor likely to shape a local's commitment to pursuing climate adaption. City governments can broadly be divided into council-manager form and mayor-council form (coded as 0 and 1 respectively). The distinction between the forms of government reflects the fragmentation or consolidation of political authority and its respective impact on politics. Since government institutions are important in passing policies and laws, their isolation or involvement with the politics surrounding the issue becomes paramount. I collect information on the forms of government partly through the International City/County Management Association (ICMA) survey on the Municipal Form of Government-2006. Since this survey is only conducted for a sample of cities and primarily medium and large cities, information on many places in my sample were not found. For the remaining cities, I searched local government web sites to correctly code the type of city government.

Interest Group Pressures: To capture the pressure from environmental groups I utilize data from the National Center for Charitable Statistics (NCCS) on environmental nonprofits (Core Data Files for 501(c)(3) organizations). These records are only available for the lowest denominator of a county and up to 2013. It can be expected that environmental groups would influence policy-making not just for the city in which they are registered, but possibly for a broader geographic area covering neighboring regions. Other studies investigating climate change policies have also applied this logic, and used the measure of environmental organizations at the county level (Wang, 2013a). For these reason, I use this measure for environmental group pressure at the county level.

Since climate change will require high GHG emitting industries to take measures to curtail emissions, there are likely oppositional pressures from the carbon intensive sectors.

Emerging research on mitigation points to growing influence of the industry lobbies that see climate policies as a threat to their businesses requiring measures that would come at a cost to them (Brulle, 2014; Dunlap & Jacques, 2013). Since climate adaptation may not entail behavior change on part of the emitters, it is not clear if this oppositional pressure will hold for building resilience. On the other hand, the industry lobby could be opposed to opening the door for any and all action related to climate change, including adaptation.

To capture this opposing pressure, I create a measure to capture the percentage of jobs within a city that are directly connected with high carbon emitting industries – mainly mining, utilities, construction and manufacturing sector. These two variables are commonly used to capture the relative strength of environmental interests versus industry lobbyists on an issue (Krause, 2011; Pollak et al., 2011).

City Resources: The capacity of a city, especially fiscal resources are an important factor in enabling a government to take policy action. Cities with higher level of economic resources are more equip to overcome financial barriers of adaptation policies. Moreover, higher levels of income within a city may be associated with more demand for better government services. To measure the fiscal capacity, I include the per capita median household income of a city.

Horizontal Diffusion: Climate change policies require understanding of scientific information and technical policy tools. Currently adaptation policies at the local level are at their nascent stage, and city governments would look to their neighbors to share information and best practices. Previous mitigation studies have used a count of the number of city adopters within a 50mile radius to a place (Krause, 2011). However, given that adaptation policies are ‘rare’, such a variable may not capture the intended meaning of neighboring cities. For my study I calculate the number of cities within a state that have undertaken adaptation planning. This is under the

assumption that cities within a state are more likely to have shared networks and resources, and utilize them for building climate resilience.

Table 2.4: Descriptive Statistics of Variables

VARIABLE	SMALL CITIES			MEDIUM CITIES			LARGE CITIES			ALL CITIES		
	Mean	Std.Dev	N	Mean	Std.Dev	N	Mean	Std.Dev	N	Mean	Std.Dev	N
<i>Level-1: City Characteristics</i>												
Disaster Frequency	96.98	85.53	133	98.55	87.94	167	117.93	95.37	161	104.87	90.45	461
Social Vulnerability Index	15.18	7.05	136	16.96	5.85	170	18.85	5.81	164	17.11	6.37	470
Public Opinion	51.85	5.73	136	54.79	4.45	170	53.97	4.84	164	53.66	5.13	470
Form of Govt.	0.50	0.50	136	0.64	0.48	170	0.49	0.50	164	0.55	0.50	470
Environmental Orgs.	17.99	21.47	109	32.80	37.16	162	31.35	33.20	159	28.51	32.90	430
Carbon Intensive Industry	22.46	11.04	136	19.35	6.65	170	19.59	4.98	164	20.34	7.86	470
Median Income	56128	30176	136	59705	23735	170	51426	16168	164	55781	23889	470
Population	10024	6974	136	55371	21548	170	366265	753433	164	150731	472745	470
Participating Neighbors	12.96	14.26	136	19.37	16.53	170	14.34	15.67	164	15.76	15.84	470
<i>Level-2: State Characteristics</i>												
Adaptation Policy	0.59	0.49	136	0.76	0.43	170	0.62	0.49	164	0.66	0.47	470
Govt. Ideology	43.78	35.24	136	54.56	35.68	170	44.59	34.81	164	47.96	35.60	470
Carbon Industry	19.92	6.94	136	18.15	6.78	170	20.26	6.79	164	19.40	6.88	470
Total N	136			170			164			470		

NOTE: *Population criteria of small, medium and large cities mimic the broader practice of city stratification used by the U.S. Census Bureau.

Small Cities (Population less than 25,000), Medium Cities (Population between 25,000 and 100,000), and Large Cities (Population more than 100,000)

B. State Variables (Level-2)

State government factors can be motivators, resources or inhibitors for local policy making. In the case of climate adaptation, the state influences are less pronounced with currently no mandatory requirements for cities to adapt to climate change. Despite this, state action and characteristics can have indirect impacts on city governments. And these forces can be both supportive (democratic institutions, state adaptation policies, healthily fiscal capacity) or oppositional (strong presence of carbon intensive industry). Keeping my models parsimonious, I

focus on adaptation policy experience, government ideology and presence of carbon intensive industry.

States adaptation policy experience is a dichotomous variable created by coding 1 if they have already created or are in-process of creating an adaptation plan, and 0 if not. This information is gathered from the Georgetown Climate Center. For institutional ideology, I rely on the measure created by Berry et al. 1998 (updated 2010, and 2015). This indicator is created through a combination of measures that represent the “center of gravity” of the state’s elected officials on a continuum from liberals to conservatives (pp.3).¹⁴ This measure reflects both chambers of a state legislature along with ideology of the governor.

Further, to capture potential oppositional pressure from the industry lobbyists who resist policy development on climate change (Dunlap & McCright, 2011). I use the contribution of carbon intensive industries to a State’s GDP. This is calculated by aggregating the GDP from the mining, utilities, construction and manufacturing sector and presented as percentage to the total GDP of a state.

METHOD OF ANALYSIS

Given the nested nature of the study, I apply a multilevel model for analysis. Multilevel models are used when the dependent variable is a function of predictor variables at more than one level (Luke, 2004). Multiple cities are embedded within a state creating clusters that are subject to the same state-level socio-economic and political influences. Results of the previous

¹⁴ Berry et al. 1998 – State Institutional Ideology calculated from the weighted average of the ideological position of each of five institutional actors - (i) the Democratic delegation in the state house, (ii) the Republican delegation in the state house, (iii) the Democratic delegation in the state senate, (iv) the Republican delegation in the state senate, and (v) the governor

chapter (See Chapter 2 on State Politics) indicate that there is considerable variability among state behavior across predictors such as EPA regions and government ideologies. These variations create state-level patterns that have uneven effects on cities within them.¹⁵

One of the assumptions of the single-level ordinary least square OLS models is that the observations and their error terms are independent of one another. However, the nested structure of cities within states can lead to a violation of this independence assumption (clustered data leading to standard errors smaller than they should be) and a greater likelihood of committing the Type-I error. Multilevel models relax this independence assumption by allowing correlated error structures resulting in an unbiased estimation (Gelman & Hill, 2007).

The multilevel model is influenced by both the individual level-1 (cities) and the group level-2 (states), where both the intercept and slope vary across level-2 units (Luke, 2004). The general equation is:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{1ij} + r_{ij}$$

where

$$\beta_{0j} = \gamma_{00} + \gamma_{01}Z_{1ij} + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

where ‘*i*’ subscript represents individuals, and ‘*j*’ subscript represents the groups informing us that a different level-1 model is estimated for each of the level-2 units (Luke, 2004). Through this structure, as desired, the intercept and slope of level-2 are allowed to vary. The intercept β_{0j}

¹⁵ There are 9 states with no cities undertaking adaptation planning – Arkansas, Delaware, Hawaii, Nebraska, New Hampshire, North Dakota, South Dakota, West Virginia and Wyoming

is based on values of the independent variables Z_{1ij} and error term u_{0j} in level-2. I use a random intercept logistic multilevel model using the statistical program STATA.

Level-1: Structural Equation

$$\begin{aligned}\eta = & \beta_0 + \beta_1(\text{disasters}) + \beta_2(\text{social vulnerability}) + \beta_3(\text{public opinion}) \\ & + \beta_4(\text{govt. form}) + \beta_5(\text{env. pressure}) + \beta_6(\text{carbon industry}) \\ & + \beta_7(\text{median income}) + \beta_8(\text{participating neighbors})\end{aligned}$$

Level-2: Structural Equation

$$\beta_0 = \gamma_{00} + u_0$$

$$\beta_1 = \gamma_{10}$$

$$\beta_2 = \gamma_{20}$$

$$\beta_3 = \gamma_{30}$$

$$\beta_4 = \gamma_{40}$$

$$\beta_5 = \gamma_{50}$$

$$\beta_6 = \gamma_{60}$$

$$\beta_7 = \gamma_{70}$$

$$\beta_8 = \gamma_{80}$$

My study is a cross-sectional analysis of city action for climate adaptation in 2015. Since conditions from a previous year are likely to result in the next year's outcomes, I lag all my independent variables by one year (2014). I develop and test parsimonious models in four scenarios – All cities, and the subset for small, medium and large cities.

2.5. RESULTS AND DISCUSSION

Findings at the State Level

The results show that none of the state level indicators influence local commitment to adaptation, and their effects are insignificant even across city types. Based on preceding DOI research, I expected state characteristics to either have a ‘snowball’ or ‘pressure-valve’ effect (Shipan & Volden, 2006), however my hypothesis are not supported by empirical results. This implies that adaptation planning among cities is driven predominantly by local politics and currently top-down pressures from the state are not systematically shaping local government action one way or another in terms of resiliency planning. One explanation for this can be that states’ merely ‘leading by example’ is not enough motivation for city governments to prepare plans. State Adaptation Plans provide frameworks and strategies, but do not explicitly require action from local governments.

Previous studies which find a significant impact of state level factors have examined policy areas with clear mention for local action (See (Feiock & West, 1993)). Similarly, mitigation studies find that where states have not directly encouraged local policy-making, the effect of state factors has been insignificant (Krause, 2011). In light of this, my null results build on previous findings and point to the need for more explicit state motivation to initiate city level action.

Table 2.5: Impact of State & Local Factors on City's Decision for Adaptation Planning

	All Cities	Small Cities	Medium Cities	Large Cities
	<i>Odds Ratio</i> (<i>Std. Error</i>)	<i>Odds Ratio</i> (<i>Std. Error</i>)	<i>Odds Ratio</i> (<i>Std. Error</i>)	<i>Odds Ratio</i> (<i>Std. Error</i>)
Level 1 City Variables				
Problem severity				
Disaster Frequency	1.000 (0.001)	0.996 (0.003)	1.000 (0.002)	1.003 (0.002)
Vulnerability				
Social Vulnerability	1.073*** (0.026)	1.109** (0.052)	1.065* (0.044)	1.063 (0.050)
Political factors				
Public Opinion	1.045 (0.036)	0.996 (0.071)	1.004 (0.058)	1.121* (0.071)
Forms of Government	0.453*** (0.106)	0.385** (0.188)	0.493* (0.190)	0.468* (0.189)
Interest Group Pressure				
Environmental Groups	1.005 (0.004)	1.036** (0.017)	1.001 (0.006)	1.007 (0.007)
Carbon Intensive Industry	0.914*** (0.016)	0.930*** (0.027)	0.912*** (0.028)	0.866*** (0.037)
City Capacity				
Median Income	1.000 (5.80E-06)	1.000 (8.89E-06)	1.000 (1.03E-05)	1.000 (1.59E-05)
Participating Neighbors	0.991 (0.009)	0.964* (0.021)	1.000 (0.015)	0.992 (0.016)
Medium Cities	0.597* (0.172)			
Large Cities	0.486** (0.145)			
Level 2 State Variables				
State Adaptation Policy	2.37e-08 (0.333)	7.38e-12 (0.311)	6.61e-11 (0.255)	5.93e-08 (0.281)
Carbon Intensive Industry	1.29e-12 (0.011)	7.42e-13 (0.022)	7.84e-13 (0.011)	3.86e-10 (0.010)
State Ideology	1.39e-10 (0.004)	4.85e-14 (0.004)	7.93e-13 (0.003)	1.61e-10 (0.004)
N	419	106	157	156
Log likelihood	-256.083	-61.707	-99.308	-87.845
Prob χ^2	0.0000	0.0317	0.0341	0.0003

Findings at the Local Level

A. Full Model with All Cities

The results are mixed at the local level. While social vulnerability, government structure and carbon industries matter; other variables are not significant in the full model.¹⁶ As expected, cities with a larger population of vulnerable communities are more likely to build resilience and prepare adaptation plans. Yet the risk from climate change is not significant. Climate adaptation by definition means building resilience to the harmful impacts of climate change. Yet most empirical studies for mitigation and adaptation do not find extreme weather events significant (Krause, 2011; Wang, 2013a; Zahran et al., 2008). While this finding is counterintuitive to my hypothesis, the result may be due to the way the variable of problem severity is operationalized. These studies, including my own, use past and current weather events and do not include measures for expected impacts in the future. Climate science suggests that the main brunt of the problem will be experienced in the next 10, 20 or 100 years (IPCC, 2014). Currently there are no large-scale local weather indicators that include future projections of climate change available for possible inclusion in the study.

The cost of adaptation has been identified as a key barrier to action (Biesbroek et al., 2013). Yet my results do not find fiscal capacity a significant factor in adaptation decision-making. One possible reason could be that the politics surrounding adaptation drives action more than the actual capacity of the local authorities. It may also be that it is costless to declare intent to plan for adaptation. For example, the cost involved for mayor to sign the RC4A or Compact of Mayors to show their commitment for climate adaptation is relatively low, and fiscal capacity would not be as strong a barrier at previously expected for adaptation policy development. This

¹⁶ Note: There is variation in how these variables play out in models on subsets for city size.

finding is also similar to politics of climate mitigation where fiscal capacity was not an important barrier (Krause, 2011). City authorities are more likely to respond to other pressures like vulnerabilities and interest group pressures when making their decisions.

While the presence of environmental groups does not lead to action, I find that the oppositional force from the carbon intensive industry is significant. Industries like the manufacturing and utilities that perceive additional cost burdens from any form of climate action pose a potential obstacle in the development of policy. Local economies with a higher contribution from these firms lead to a decrease in the probability of policy adoption. This finding is in line with previous research on urban politics, where local politicians are more inclined to prioritize development and industry interests (Feiock et al., 2010; Lubell et al., 2009; Stone, 1980).

The industry lobby has been a strong and successful oppositional factor for mitigation policy adoption (Krause, 2011). These findings have implications for designing policy strategies to overcome oppositional pressures. For example, federal and state governments can provide financial incentives to industries to help transition from carbon intensive activities to cleaner technologies that reduce emissions. Such financial and technological motivations could possibly reduce the threats faced by the industry lobbyists, and gain more traction on policies to build resilience.

Similar to previous studies, my results also show reduced commitment for building resilience among cities with mayor-council forms of government (Bae & Feiock, 2013). As hypothesized, mayor-council governments are more likely to be affected by the politics surrounding the issue, and with climate change being highly contentious; my results show that they are less likely to adopt plans. Since we do not expect cities to change their form of

government in the near future, state and federal support for local adaptation planning would need to be tailored based on the institutional characteristics at the local level.

There is no evidence of horizontal diffusion among the cities. This is an unexpected result, especially with mitigation studies showing a strong influence of neighboring cities (Krause, 2011). This maybe because climate adaptation policies are still at a nascent stage and have lagged in their development in comparison to mitigation, much like the pattern in state adaptation. Cities currently planning of adaptation are the leaders on the issue and taking action on their own initiative.

Last, my results show that population size matters, and small cities are significantly different from medium and large cities. Similar to studies on sustainable development (Portney, 2009), smaller cities lack resources and capacity needed for planning and have different factors that influence their decisions on adaptation planning (Lubell et al.,2009). This suggests theoretical and empirical evidence for a deeper analysis on city size, which is discussed in the section below.

B. Closer Look at Variation across City Size

Models for small, medium and large cities show very interesting results. Results in Table 2.6 are based on calculating the effect size of different predictors when all variables are held at their mean and the variable of interest increases from its mean to one standard deviation above mean. This gives the change in likelihood of commitment for building resilience and adaptation. The influence of some local level factors is consistent over cities but with differing substantial effects, while other factors vary in significance themselves. These differences are most pronounced between small and large cities.

Table 2.6: Substantive Effect of Variables on Making Commitments for Climate Adaptation

Independent Variable	Change in Likelihood of Adopting
<i>All Cities</i>	
All variables held at their means	0.082**
Social Vulnerability – (1 std. deviation increase)	0.533***
Carbon Intensive Industry - (1 std. deviation increase)	- 0.687***
Govt. Form - (0 to 1)	- 0.261*
<i>Small Cities (population <25,000)</i>	
All variables held at their means	0.254
Social Vulnerability - (1 std. deviation increase)	1.042**
Carbon Intensive Industry - (1 std. deviation increase)	- 0.713*
Environmental Interest Groups -(1 std. deviation increase)	1.006***
Participating Neighbors - (1 std. deviation increase)	- 0.189
Govt. Form - (0 to 1)	- 0.169*
<i>Medium Cities(population 25,000 to 100,000)</i>	
All variables held at their means	0.008
Social Vulnerability - (1 std. deviation increase)	0.372
Carbon Intensive Industry - (1 std. deviation increase)	- 0.613**
Govt. Form - (0 to 1)	- 0.244
<i>Large Cities(population >100,000)</i>	
All variables held at their means	0.064
Public Opinion - (1 std. deviation increase)	0.593*
Carbon Intensive Industry - (1 std. deviation increase)	- 0.665**
Govt. Form – (0 to 1)	- 0.321

*p < 0.1; **p < 0.05, ***p < 0.01

Larger cities are most affected by the politics surrounding climate change. This is visible through the relatively higher substantive effects of the political factors. When large cities have mayor-council governments, they are more likely to reduce commitment for building resilience communities. Additionally, larger city governments are highly responsive to the opinion of the public while making decisions (public opinion is not statistically significant for small/medium cities). It is interesting to note that the prominence of these political factors outweighs the impact

of climate risk and community vulnerabilities. My results don't find problem severity variables significant in large cities.

Oppositional pressure from interest groups is significant for all three city types. But it's the smaller cities that are most affected by interest group politics. On the one hand small cities with greater contribution of the carbon industry are the least likely to adopt policies. On the other hand, when the presence of environmental groups is increased, it doubles their likelihood to prepare for climate adaptation. Closer examination of the substantive effects of these competing interest group pressures reveals that environmental groups are more effective in lobbying for climate action than their industrial counterparts. This finding is encouraging for pro-climate action, yet is limited to small cities.

Lastly, the evidence of horizontal diffusion is only visible for small cities, and is negative. Small cities may lack the resources and capacity to prepare for climate adaptation (Carter & Culp, 2010) and see action by neighboring cities as an opportunity to free-ride on benefits. This finding requires deeper investigation.

2.6. CONCLUSION AND WAY FORWARD

There are interesting patterns observed in local adaptation planning. First, state level characteristics and state policy experience do not have a significant effect on city action. States are leading by their own example and planning for resilience, yet these plans currently don't mandate local action or inaction. Previous research analyzing the quality of city plans show that most strategies are reactive and constitute low-hanging fruits (Bierbaum et al., 2013). I also find that cities are not looking to their neighbors to either compete or share information and are currently more likely to free-ride other government's actions. In order for us to see more

proactive and comprehensive local planning, direct encouragement from higher government institutions could be necessary. Perhaps more explicit positive incentives such as grants and resource sharing or more negative carrot-and-stick approach with enforcement threats or penalties maybe required.

Second, local level characterizes do effect decisions by city governments. When examining cities in general, factors such as social vulnerability, government structure and opposing interest groups from the industry matter. Unfortunately, most of these factors are static or difficult to change in the short term. Given the influence of social vulnerabilities, it would be helpful to continue to conduct sophisticated assessments of the potential risks and coping capacities of communities at the local level. A clearer understanding is likely to give policymakers important information need for planning.

Lastly, planning for adaptation varies by city size. This finding sheds light on an area not previously studied in adaptation. Smaller cities respond differently to local factors than larger cities. Studies on sustainability policy have indicated that smaller cities lack the capacity and resources and have lagged behind in policy development (Portney, 2009). With a better indication of the likely factors that support or suppress adaptation planning among small cities, this outcome can be different. It is encouraging to see that the presence of environmental groups is a strong catalyst in policy development.

Larger cities seem to respond to the heated politics of climate change. Over the years we have seen a growing support of climate change among the American public (PEW, 2014). This trend can help larger cities follow the public opinion and expand action to build resilience. Overall, the results are promising and provide a clear indication of the different predictors for local adaptation planning.

Way Forward: This chapter is among the few large scale quantitative analyses on local adaptation planning. While the results are interesting, these findings necessitate further investigation into this contemporary issue. First, the dependent variable can be expanded to explore policy adoption and policy intensity or ambitiousness. As investigated in the previous chapter on state politics, policy ambitiousness can help distinguish ‘deep’ versus ‘shallow’ commitment, and deepen our understanding of the decision making process. Second, the study can be expanded from a cross-sectional analysis to panel data spanning over a period of time. The longer time horizon will allow for more variation in the variables, as well as increase the sample size to give more predictability capacity to the models.

Third, with the results suggesting interesting patterns among the interest group pressures and forms of governments, it would be useful to expand the investigation by testing conditional effects from factors. And lastly, there is a need to develop better measures for problem severity and impacts that more accurately represent impacts of climate change by incorporating future climate scenarios and projections. The impacts of climate change are only expected to increase in intensity and frequency. Innovative action by cities is still at its nascent stage, and adaptation planning is expected to grow among local governments.

CHAPTER 3

UNPACKING THE COLLABORATION “BLACK-BOX” – A FRAMEWORK TO ANALYZE STATE ADAPTATION PLANS

“Coming together is a beginning; keeping together is progress; working together is success”
- Henry Ford

3.1. INTRODUCTION

In 2014, the *President’s State, Local and Tribal Leaders Task Force on Climate Preparedness and Resilience* provided a systematic overview of potential impacts of climate change in the United States. The report predicts significant adverse impacts from climate change, including negative health and economic implications, which are expected to escalate as climate change continues. Even with measures to reduce Greenhouse Gas Emissions (GHGs), with the current levels of emissions in the atmosphere, the negative consequences of climate change are expected to continue in the near future. This requires governments to take adaptation action in concurrence with mitigation measures (IPCC 2014).

Adaptation is an on-going process to reduce the vulnerability to climate change and increase the resilience of human, biodiversity and infrastructure capacities. The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as “*adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*” (IPCC, 2012; pp.556). Adaptation strategies vary across geographic locations and scale, and in types of initiatives. They involve multiple sectors like water, health, infrastructure, biodiversity and emergency preparedness, and

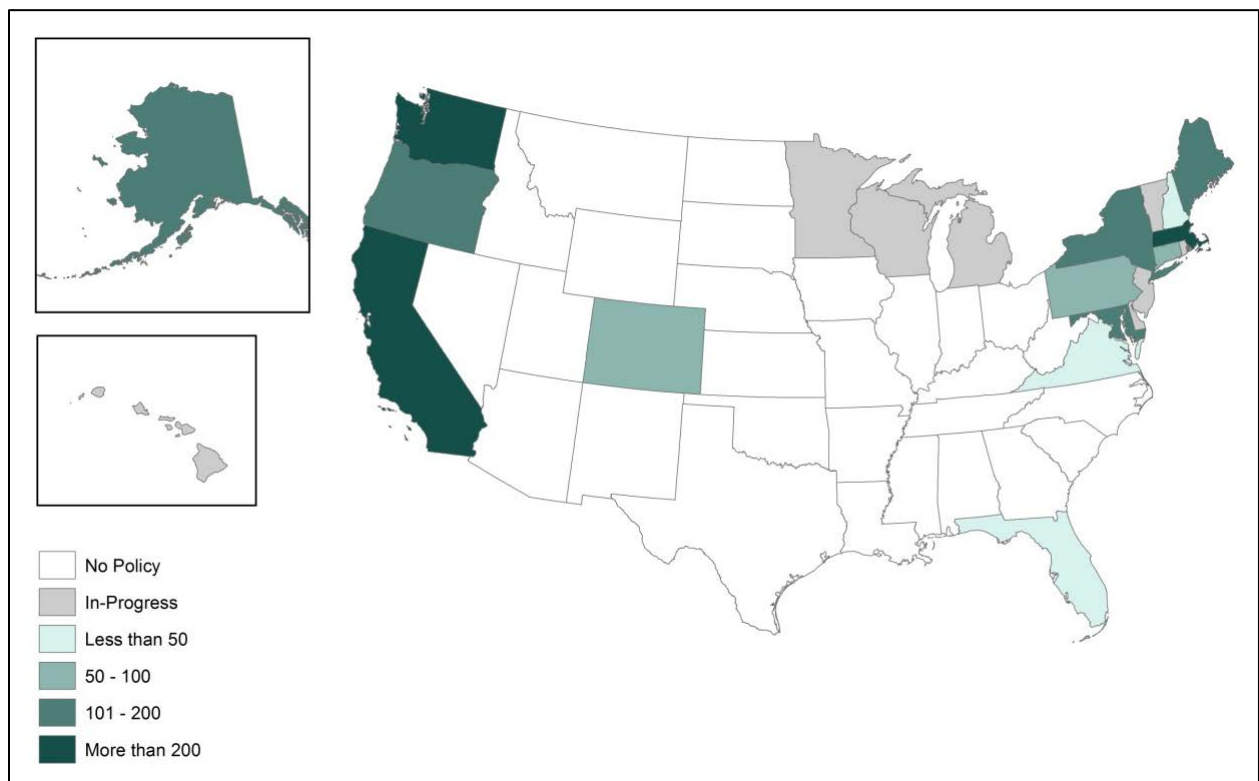
different organizations and stakeholders. For example, the state of California is a leader in climate adaptation action and recommendations initiatives ranging from integrating climate change in land-use planning, providing education and outreach through public communication, developing web-based tools to monitor health initiatives, and expanding surface and groundwater storage for increased water availability (California Climate Adaptation Strategy, 2009).

These strategies come at high economic costs. It is anticipated that the North Atlantic states would incur cumulative costs exceeding \$88 billion by 2100 from sea-level rise and coastal flooding; the Midwest will require more than \$6 billion in infrastructure investments to cope with higher temperatures; and California alone would require more than \$4 billion in investment every year for the next ten years to maintain its drinking water infrastructure (EOP, 2014).

Despite these costs, there is growing evidence showing potential benefits in taking timely resilience action. Sparks (2008) finds that implementing coastal zoning restrictions and remediation action now can have a net present value of \$150 million over 25 years, over taking no action. Other studies point to the potential synergies between reducing Greenhouse Gas Emissions (GHGs) and adaptation measures, providing opportunities for co-benefits. For instance, planting trees can act as carbon capturers and reduce GHGs, while at the same time reduce urban heat island effects and exposure to extreme heat, leading to health benefits (Harlan & Ruddell, 2011). In light of these benefits and growing impacts from weather related events, policymakers are increasingly viewing adaptation as a 'risk-management' strategy (GAO, 2009).

As is common in many areas of environmental policy, and climate change in particular, in the United States, subnational governments are leading the charge (Glicksman, 2010; Rabe, 2008; Smith et al., 2010). Among states, most action for adaptation is still at its nascent stage and

focus primarily on planning. To date fourteen states have prepared State Adaptation Plans (SAPs), and eight others are in the process of writing their plans (See Figure 3.1- U.S. States with State Adaptation Plans). In addition to these state-wide initiatives, some states have prepared sector-specific plans that incorporate climate change risks and impacts into agency activities. For example, North Carolina and South Carolina do not have SAPs, but are revising their state wildlife plans to consider long term climate change (Georgetown Climate Center, 2015).



Source: Institute for Policy & Social Research, The University of Kansas; Data from Georgetown Climate Center. The map provides an overview of the number of goals set by states in their State Adaptation Plans (SAPs). States with plans =14; In-progress=8; No plan=28

Figure 3.1: U.S. States with State Adaptation Plans (SAPs)

Need for Collaboration: The impacts from climate change are diverse, unevenly distributed across communities, and in the long term, negative (Eagan & Mullin 2016). These impacts cut across political and economic boundaries and create a range of challenges in

different economic sectors, government agencies, and levels of government. Extreme weather events, like the North American blizzard of January 2015, affected multiple states spanning the Pacific Northwest, Central, and Eastern Regions of the country. This disaster damaged property like housing and city infrastructure, disrupted transportation and communication, and left many low income communities in dire circumstances. Agencies spanning different levels of government and across sectors like emergency preparedness, infrastructure, water and health took recovery measures in the aftermath (CNN, 2015).

Similar to policies designed for sustainable development and cross-cutting environmental issues, successful adaptation to adverse impacts stemming from climate change will require a high level of collaboration between multiple levels of governments and a range of stakeholders (Portney, 2015). This is true not only because the nature of the problem (extreme weather events, temperature variations, sea-level rise) can span a broad geography, but also because political fragmentation in a federalist system often results in no one agency having autonomy over the sectors and strategies that are likely to be part of an effective approach to boosting resilience and promoting adaptive capacity. For example, a single agency approach to water quality and supply management would overlook important interconnections between areas like agriculture, flood control and urban development (Daley, 2013).

Working with various stakeholders such as the private sector, non-governmental organizations, researchers and local community is also an important component to successful planning and implementation. Formal and informal networks among stakeholders can be developed to focus on conflict resolution, decision making and execution of policy strategies (Daley, 2013). Such partnerships have commonly emerged for water management within the spatial boundary of a watershed, which crosses the typical political or jurisdictional borders

(Sabatier et al., 2005). Stakeholder involvement in the case of climate adaptation can particularly benefit through sharing of knowledge and information on the local context of impacts, as well as create public private partnerships for service delivery (DeLeon & Varda, 2009; Sabatier et al., 2005).

Among the stakeholders, the representation of the public is emphasized in adaptation planning. Public participation or civic engagement in policy decision-making is a basic parameter for democratic government systems. Public participation can also have various practical benefits. When the community is involved in the planning process, it can result in better decisions that are more broadly supported, while also support improving the likelihood of successful policy and program implementation (Dietz & Stern, 2008). Engagement of public includes various activities such as attending public meetings, presence on community advisory board, public notice and comments processes, public hearings, and negotiated rule making (Daley, 2013).

Collaborations can also reduce the chances of maladaptation or negative unintended consequences. Cross-agency and stakeholder partnerships help ensure that resilience measures taken by one organization do not adversely impact another. Instances of maladaptation are not uncommon. Berke et al. (2015) find that various local plans designed to reduce vulnerability to climate change for a specific location (hazard mitigation, infrastructure, parks and recreation) due to weak identification of overlaps and spillovers across agencies, resulted in an increase in physical and social vulnerability to hazards. Land use plans could designate some spaces as coastal hazard zones, while a capital improvement plan could allocate funds for infrastructure development through roads, water and sewer utility expansion in the same area (Berke et al., 2015). Such conflicts have also been cited between policies for mitigation and adaptation (Lee &

Van de Meene, 2012; Kirshen et al., 2008). Rise in summer temperatures increase the energy demand for cooling equipment usage in residence and commercial buildings. To meet increased demand, policymakers may devise strategies to augment generation of electricity. This may result in higher emissions and decrease air quality; thereby negatively affect the health of the local population (Kirshen et al., 2008).

Purpose of Study: Government agencies and international organizations have long recognized that collaboration will be a critical tool to address both climate mitigation and climate adaptation. Having diverse stakeholders meaningfully involved in adaptation planning is an important factor that can help increase the chances of successfully achieving policy goals (EOP, 2014; ICLEI, 2007; UNDP, 2005). Despite this, there is very little research aimed at understanding the nature of collaborative relationships and the policy tools most frequently used.

Previous works have largely focused on analyzing the incentives and barriers to planning for adaptation, or understanding the substantive outcome of strategies implemented to build resilience (Biesbroek et al., 2013; Preston et al., 2011). A few other studies have examined the quality of adaptation policy documents using methods of plan quality evaluation (Berke et al., 2015; Berke & Conroy, 2000; Lyles et al., 2014; Woodruff & Stults, 2016).

While these studies are necessary, they are not sufficient in describing the quality of collaboration. Planning documents are indicative of the commitment of action by government authorities. Therefore, exploring the ways collaborative relationships are documented and discussed in state and local adaptation plans is important, yet understudied. We know little about which sectors and agencies undertake collaboration more frequently, or the nature and tools applied within these partnerships. There is a need for deeper investigation within the types of collaboration undertaken to predict the potential success of collaborative action.

To address these pertinent questions, in this chapter I develop a framework for analysis of the quality and nature of collaboration within state climate adaptation plans. To do so, I merge insights from theories of collaborative governance, public participation, environmental decision making and plan quality evaluation. Using the *Collaborative-Government-Regimes (CGR) Framework* as my base structure (Emerson & Nabatchi, 2015), I incorporate insights from scholarship that explores both public participation and inter-governmental involvement, and situate these components within the specific context of climate change.

Research Question: To better understand the quality of collaborative partnerships in adaptation planning, I ask multiple inter-related questions – Which agencies are more likely to collaborate with one another to develop and implement strategies for climate adaptation, and do we see any patterns among these partnerships? Which stakeholders are involved in building climate resilience, and what are the means and tools used for these collaborations? Further, what is the importance given to collaboration within adaptation policy documents, and at what stages of the policy process are these partnerships most evident?

The main focus of this chapter is to develop a broad framework of analysis, which I call *Collaboration-in-Adaptation (CIA) Framework*, by embedding these questions into a structure that is logically and theoretically sound and applicable to adaptation plans across various levels of government. First, I provide an overview of climate adaptation and key characteristics of the problem. I then present a conceptual background on collaborative governance, public participation, principles for plan quality evaluation, and explain the need for collaboration presented in various national and international frameworks. Thereafter I delve into the CGR and tailor the framework to my research questions, coding schemes, and outline areas where I merge in other relevant theories. This is followed by a preliminary application of the framework on four

state adaptation plans (Alaska, Florida, Colorado and Massachusetts) and a broad discussion of two coding components – sectors involved in collaboration, and diversity of participants in collaboration. I end the chapter with a discussion on limitations and the way forward.

3.2. BACKGROUND ON CLIMATE CHANGE ADAPTATION PLANNING

Planning for adaptation involves incorporating current and future climate impacts into decision making in order to build resilience and cope with the advent of climate change. Adaptation planning in the U.S. is still at its nascent stage. Early works examining climate change plans find that they dealt overwhelmingly with mitigation measures, and adaptation was often merely a section within a larger policy document (Wheeler, 2008). This limited focus on resilience and coping initiatives led many scholars to investigate the obstacles to adaptation planning. Scholars identify four board hurdles, mainly leadership (within the government or interest groups), resources (such as economics and technology), communication and information flow (including public participation), and values and beliefs on anthropogenic climate change (Ekstrom & Moser, 2014).

As policymakers gradually overcome these barriers, there has been a recent growth in stand-alone adaptation plans among state and local governments. To date fourteen states have developed their own SAPs (Georgetown Climate Center, 2015) and over forty four local governments have developed adaptation plans (Woodruff & Stults, 2016). State and local plans serve as a signal indicating the understanding and commitment of a government to building resiliency in the face of climate change. Whether a city or state has an adaptation plan, the

involvement of different stakeholders, commitment of resources, and types of goals set, all suggest the desire for action and the potential success of initiatives (Wheeler, 2008).¹⁷

As is commonly the case with subnational environmental policy, there are no standard approaches to climate adaptation planning, and documents vary widely on length, number of goals, timeframe for action, and tools and mechanisms applied. For example Chicago, Illinois has multimillion dollar undertakings spread over a long time horizon, while Houston-Galveston, Texas the plan is significantly less intensive and broad. Cities like New York draw heavily on creating scientific teams to predict local climate impacts while others such as Keene, New Hampshire mainly downscale national or regional projections to assess local climate impacts (Poyar & Beller-Simms, 2010). This variation among plans is also visible between state governments. Florida has set only 28 goals that mainly focus on planning and capacity building, while states like Massachusetts and California have 373 and 345 goals respectively, and go beyond capacity building to include post-implementation and monitoring strategies (Georgetown Climate Center, 2015).

In general, these different approaches of plans have broadly been categorized into three groups. The first group is comprehensive adaptation plans, in which cities or states prepare cross-cutting strategies based on climate impact assessments and vulnerabilities. The nature of this method is more inclusive of different stakeholders and public participation, and is less likely to result in maladaptation (Adger et al., 2005). The second set of strategies involves integrating climate change into existing practices, without a separate planning process. This is often

¹⁷ An adaptation plan can only be successful if implemented. I acknowledge that symbolic politics could be at play, especially with climate change being a highly contentious issue. But at a minimum, a well-developed plan indicates that the public sector has deliberated on and invested resources for developing a plan, indicating a desire to move beyond symbolic politics.

understood as “mainstreaming” climate adaptation. This group of strategies has potential advantages like bypassing the long planning procedure and directly incorporating adaptation into government processes (Berke et al., 2012; Preston et al., 2011). However these strategies run the risk of maladaptation if the approach is not closely aligned with community values and norms.

The third set of strategies are “no regrets” and co-benefits. These are actions that have beneficial effects even if climate change impacts do not occur, or are indirect benefits of other policies such as those for climate mitigation (Hamin, 2012). While an adaptation plan can have a combination of all three groups, researchers and experts continue to point to the first category or comprehensive adaptation planning being most effective in addressing long term climate change (Hamin, 2012). This assessment is predicated on identifying successful adaptation policies.

Adger et al. (2005) define successful adaptation strategies or decisions as dependent on “*how that action meets the objectives of adaptation, and how it affects the ability of others to meet their adaptation goals*” (pp.78).

Planning for adaptation would need to accommodate some level of uncertainty and allow for strategies to be flexible with changing circumstances (Adger et al., 2005). Scientific evidence on current and projected climate impacts and its consequences on infrastructure and communities (through vulnerability assessments) are necessary for baseline information in plan preparation. Over the past few decades, models to predict climate risks have been evolving to better capture complexities of the real world. These complexities arise from the interconnectedness of natural phenomenon, such as ocean currents, air and water cycles, and clouds, wind and weather patterns. Scientific models for climate change are built on many assumptions of these patterns, and include some degree of uncertainty. This poses a challenge for policymakers to device

strategies that take some degree of uncertainty into account. Failing to address uncertainty could make implementation of proposed strategies less effective.¹⁸

Previous Research: Studies evaluating adaptation plans have primarily focused on case study analysis among municipalities and local governments. Preston et al., (2011) examines 57 plans from Australia, the UK and US, and compare inputs required to achieve program goals against the actual outputs, and find that adaptation plans are largely underdeveloped (evaluation scores between 16% to 61%, and average of 37%). The documents did not holistically consider factors beyond climate (e.g. social and economic vulnerabilities), lacked commitment of various capital resources needed, and were biased towards capacity building programs which are lower risk strategies as compared to specific actions to reduce vulnerability (Preston et al., 2011). The study utilized a Logic Framework Analysis (LFA) which is helpful in evaluating program goals, but provides limited guidance for assessing public participation and inter-organizational coordination, both of which are critical components needed to develop and implement climate adaption programs.

Other more inclusive studies scan material submitted by federal, tribal, state, and local government officials, and the private sector for the U.S. National Climate Assessment. This includes documents like Executive Orders, research plans, planning documents and grey literature (Bierbaum et al., 2013). While expansive in the scope of material analyzed, they assess the breadth of adaptation strategies and barriers to resilience planning, but do not examine the quality of critical factors, such as stakeholder involvement and broad collaboration. Other studies have devised plan evaluation criteria from adaptation literature and focused on factors such as

¹⁸ A common approach to incorporate uncertainty in plans is using a ‘scenario planning exercise’ whereby climate impacts are assessed on different levels of GHG emissions and the resulting severity of the problem (IPCC, 2014)

economic efficiency of initiatives, equity of program costs and benefits, robustness through incorporating uncertainty, and potential for mitigation co-benefits (Poyar, 2010). Yet again, this research pays scant attention to collaboration.

To date, the most comprehensive evaluation of adaptation planning in the U.S. is by Woodruff & Stults (2016) who analyze 44 city and local government plans using the principles of plan quality evaluation (see Section 3.3.C on Evaluating the Quality of Plans, below). They score plans on qualities such as clarity in articulation of goals, degree of public participation, involvement of other stakeholders, implementation and monitoring. Results suggest that local governments have failed to prioritize strategies, and lack details on implementation processes (Woodruff & Stults, 2016). While the study's findings are notable, there is a need for expanding our understanding on public participation and collaboration. For example, in their coding scheme the authors identify coordination between different stakeholders such as the nonprofits, businesses, and local universities, but do not evaluate the type of collaborative goals set, tools and mechanisms applied, or which stakeholders and government agencies most frequently developed partnerships. My research builds on this work by creating a framework to better analyze these aspects, and in an understudied area of state adaptation plans.

3.3. COLLABORATION & CLIMATE CHANGE– A CONCEPTUAL BACKGROUND

In this section I provide a conceptual understanding of collaborative governance, public participation, and plan quality evaluation within adaptation planning.

A. COLLABORATIVE GOVERNANCE: Emerson & Nabatchi (2015) define collaborative governance “*as the processes and structures of public policy decision making and management that engage people across the boundaries of public agencies, levels of government,*

and/or the public, private, and civic spheres to carry out a public purpose that could not otherwise be accomplished” (pp.18). The basic premise for collaborative governance is to bring together multiple stakeholders, across varying levels of government and agencies, to address complex problems that have high levels of uncertainty, and cannot be effectively tackled by traditional policy tools (Agranoff, 2003; Lubell, 2003; Niles & Lubell, 2012; Sabatier et al., 2005). Collaboration can occur in the vertical direction between levels of government in the U.S. federalist system, or horizontally across government agencies, the private sector, community and other stakeholders (Agranoff, 2006).

Collaborative governance has become more prominent with the emergence of more cross-cutting and global issues (like climate change), and growth in technology that allow connections across geographic distances. Calls for collaboration tend to increase when the problem at hand is ambitious or complex. This is especially true when the issues are salient (Sabatier et al., 2005) and difficult to resolve. The so called ‘wicked problems’ or those that are not easily solved by single agency and require multiple agencies working together, are more likely to result in collaborative governance (Lubell, 2003; McGuire, 2006).

Climate change falls well within the definition of a ‘wicked’ problem. In the US, where fragmented authority is the norm, enhancing climate resilience will require widespread collaboration that is multi-sector, interagency, public-private, and include meaningful public participation mechanisms. With the rise in complexity of problems, non-governmental actors have also become an increasingly important component in policy implementation. Different non-governmental actors such as the private sector, not-for-profit organizations and even community members have forged alliances and long term partnerships ‘to do what the governments alone

cannot do' (Agranoff, 2003). An example of this is the public-private-partnerships developed to improve the likelihood of efficient service delivery for public programs (O'Leary & Vij, 2012).

Various international and national frameworks for adaptation stress the need for collaboration to effectively address climate impacts (EOP, 2014; UNCP, 2005). Such partnerships and engagement of stakeholders are needed from the outset in the planning and decision making stage, and should be detailed within adaptation policies and strategies (EOP, 2014). These collaborations are fairly under-tested in adaptation and resilience planning among state governments.

B. PUBLIC PARTICIPATION: The discussion on collaboration is incomplete without delving deeper into the issue of public participation and the involvement of different stakeholders.

Normatively, democratic governance encourages the representation of opinions and needs of a diverse set of participants in policy decision-making (DeLeon & Varda, 2009). Public participation within collaboration is predicted to result in better evaluation of competing demands, and achievement of democratic ideals (Daley, 2013). Broad stakeholder involvement in planning for adaption, while time consuming, may increase the chances of successful implementation because local knowledge of the problem and local norms are brought to bear in the planning process (Daley, 2013). Scholars emphasize that both major and minor interests on the policy issue should be represented within public participation (Innes & Booher, 2003).

Studies have also shown that when stakeholders are involved in the policy process from the planning to implementation stage, there is better buy-in from community, reduced conflict, and greater success of achieving policy goals (Prell, 2003). In the context of climate change, Preston et al. (2011) has developed criteria for high quality adaptation plans and emphasizes that

when participatory processes are strengthened, it leads to higher success of adaptation planning. There are many similar definitions of public participation in literature. For this chapter, I apply Dietz & Stern (2008)'s holistic description that defines public participation as "*organized processes adopted by elected officials, government agencies, or other public-or-private sector organizations to engage the public in [environmental] assessment, planning, decision making, management, monitoring, and evaluation*" (pp.11).

For this broad definition, 'public' within public participation are not merely individuals or their collective interest through groups, but also includes a wide range of participants who may be identified as interested or affected persons within the policy issue. It includes those who effect and those who are affected by policy choices (DeLeon & Varda, 2009). Participants are context specific, and depending on the issue, actors may vary on involvement and degree or participation (Renn & Walker, 2008). In the context of climate change, there might be a slight variation among stakeholders for mitigation and those for adaptation. For example, with the primary goal of mitigation being a reduction in GHG emissions, carbon intensive industries like the manufacturing sector would likely be among the key stakeholders. The presence of these industry lobbyists might be relatively lower for the case of adaptation, where more focus could be placed on vulnerable communities and weather-dependent sectors like agriculture and insurance.

Collaborative public participation does not necessarily ensure effective policy outcomes and steps must be taken for meaningful involvement. Historically, low income and minority communities have had relatively less access and influence in environmental decision-making processes, as compared to well-educated and wealthy individuals (Dietz et al., 2008; Daley, 2013). For precisely these reasons, plan quality evaluations for adaptation need to move beyond

reviews with checklists for diversity of stakeholders, and include measures to capture the degree of access, especially of the vulnerable communities.

Debates within public participation literature have identified potential measures that would increase the likelihood of success. An influential work by the National Research Council points to five key dimensions of good public participation, mainly who is involved with participants selected based on the context of the problem; at what points of the policy process they are involved to allow sharing of opinion throughout the policy cycle; intensity of stakeholder involvement with efforts to enhance and maintain partnerships; the extent of power or influence of different actors; and clear goals for collaboration (Dietz & Stern, 2008; pp. 14). I will employ these key dimensions of public participation within my framework for evaluation.

C. EVALUATING THE QUALITY OF PLANS: In general, research has demonstrated that higher quality plans are more likely to result in successful implementation and addressing the policy problem (Lyles & Stevens, 2014). To ensure a rigorous process for planning is undertaken, there is a growth in standards and principles of the evaluation of plan quality.

Criteria for ‘plan quality evaluation’ have existed in the field of public administration for over 5 decades. Early works in the 1970s by Gruft & Gutstein (1972) developed a set of criteria for empirical evaluations based on clear rational processes, democratic participation and representation of all stakeholders in planning. These measures were extended by Baer (1997) who created a general plan evaluation framework with over 60 criteria that analyzed the goals, procedural consistency (involvement of multi-governments, stakeholders), implementation and feedback. This framework has been applied and tested by many scholars and has been a base skeleton for many plan evaluations.

More recent works by Berke & Godschalk (2009) conducted a thorough analysis of prominent plan quality studies across various policy domains and compared existing indexes within literature. This thorough investigation resulted in a structure with six principles for plan evaluation, which are considered 'standard' principles and applied extensively in literature (Lyles & Stevens, 2014). These are 1) Goals and breadth of vision 2) Fact base empirical foundations (e.g. climate impact and vulnerability assessments) 3) Actions to achieve goals 4) Implementation and monitoring details 5) Inter-organizational coordination, and 6) Participation. The first four principles are grouped as internal dimensions of plan evaluation, and focus on the content and format of the plan. The last two principles are grouped into external dimensions (principle 5-6) and assess how the plan fits within the local context and influences (Berke et al., 2012), and are most relevant to my research question.

These criteria for plan quality have been applied to diverse policy areas, including environmental policy making. Scholars have tested land use and building code rules (Nelson and French 2002), mitigation strategies among local governments (Dalton and Burby 1994), and zoning regulations among cities (Norton 2008), to name a few. While the majority of these studies are at the city and local level, the application of this framework to state level analysis is still limited (Lyles & Stevens, 2014).

It is also pertinent to expand existing inter-organizational scorecards to go beyond identification of participants, to deeper investigation of the nature of these relationships such as the goal for which these partnerships were established, the stage of participation in the policy process, the time frame of partnership, and the tools and mechanisms applied to achieve coordination, which are not investigated in detail.

3.4. DEVELOPMENT OF THE ANALYSIS FRAMEWORK

In the previous section I have provided a brief overview of the background and key concepts on collaboration, public participation and climate adaptation planning. In this segment I will discuss the framework for analysis of coordination in adaptation planning. This framework is a variation of the “Collaborative Governance Regimes” (CGR) proposed by Emerson & Nabatchi (2015), and incorporates elements of concepts from public participation and plan quality evaluation; and tailors these to policy domain of adaptation planning (See Figure 3.2). I will first explain the CGR framework, and then discuss how I operationalize each of the framework pieces of fit the chapter’s research question.

Emerson & Nabatchi (2015) have undertaken extensive research on collaborative governance, combining relevant work by various scholars to integrate different pieces of collaborative governance. They call this framework the “Collaborative Governance Regime” (CGR). This framework was first presented in 2012, and after incorporating feedback from practitioners and researchers, a revised framework was presented in 2015. My chapter is a variation of this most recent version of the collaboration structure.

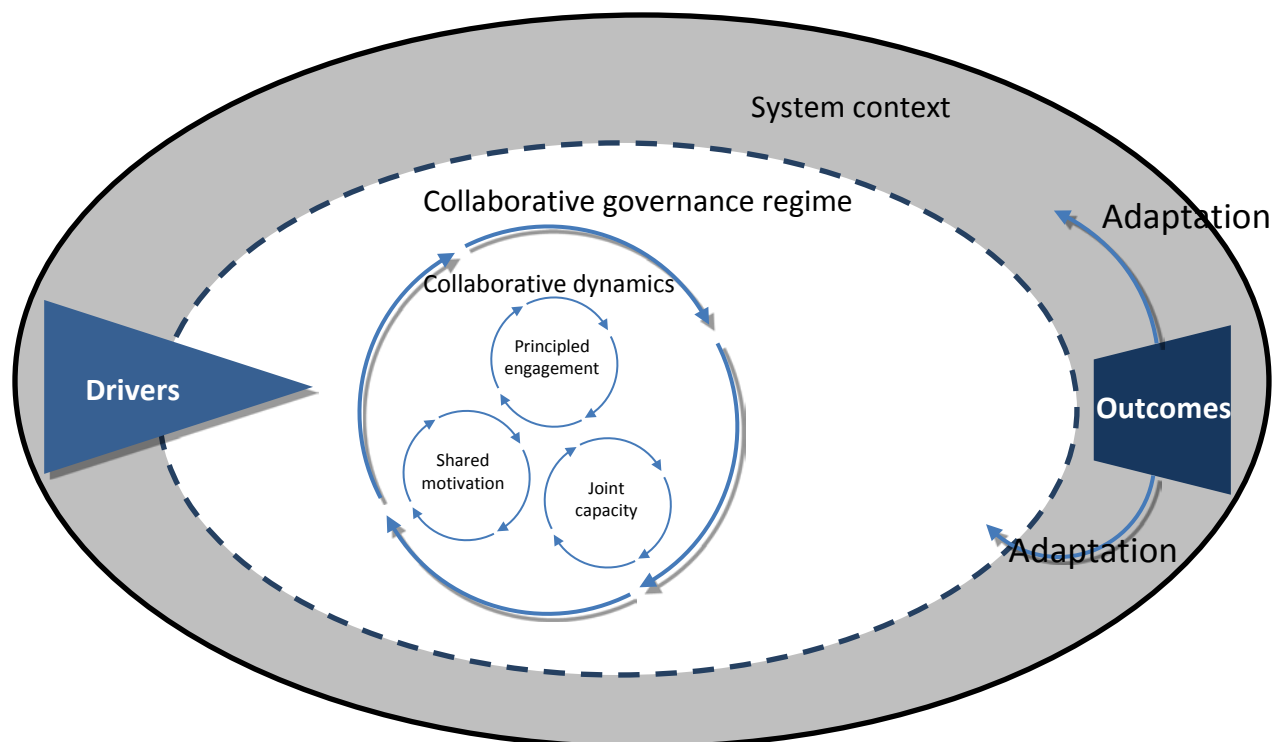


Figure 3.2: The Collaborative Governance Regime (CGR) Framework by Emerson & Nabatchi (2015)

The Integrative framework for collaborative governance (refer Figure 3.2) depicts set of nested elements that work together in a “*dynamic, nonlinear, iterative fashion*” (pp.26). CGR framework is broad and can be applied to various policy contexts. The pieces of the framework provide a structure with general concepts to understand collaboration and working across boundaries. However, the structure of CGR lacks elements of agency or a description of the actors and participants. This is where the merging in public participation and plan evaluation principles enhances our understanding of collaboration. I modify CGR by integrating stakeholder participation, inter-organizational coordination, and concepts specific to climate adaptation planning (e.g. maladaptation). I name this the *Collaboration-In-Adaptation (CIA)* Framework. Table 3.1 outlines the details of the CIA framework and serves as a coding guideline.

Table 3.1: Collaboration-In-Adaptation (CIA) Coding Framework

Factors	Framework Description	Research Question	Description	Coding Scheme
I. DRIVERS				
1. Uncertainty	<ul style="list-style-type: none"> - Wicked problems (Emerson & Nabatchi, 2015); - Problem severity and salience (Sabatier et al., 2005); - Diagnosis of the context (Dietz & Stern, 2008) 	Q.1. Do the descriptions for climate change impacts discuss need for collaboration? (<i>same as Principled Engagement, below</i>)	Descriptions of climate change as a problem that crosses sector and agency boundaries	PROBLEM DEFINITION 1-Cross-sector 2-Sector-specific
2. Interdependence	<ul style="list-style-type: none"> - Mutual reliance, unable to accomplish goal on their own (Emerson & Nabatchi, 2015); - do what they can't do alone (Agranoff, 2003); - Strategies for climate adaptation may overlap across agency boundaries (EOP, 2014; UNDP, 2005) 	Q.2. What sectors plan to collaborate? Are there any patterns of partnerships developed?	Standard practice in adaptation literature use the classification of 9 EPA Sectors (Georgetown Climate Center, 2015)	SECTOR 1-Agriculture 2-Biodiversity 3-Coasts 4-Forestry 5-Emergency 6-Health 7-Infrastructure 8-Water 9-Others 10-Mitigation 11-Adaptation (general)
3. Consequential Incentives	<ul style="list-style-type: none"> - Internal pressures (issues, resource needs, interests, or opportunities) or external pressures (situational or institutional crises, threats, or opportunities) (Emerson & Nabatchi, 2015); - clarity of purpose (Dietz & Stern, 2008) 	Q.3. What are the reasons for collaborating? Is there clarity of purpose for collaboration? (<i>same as OUTCOME, below</i>)	Goals, purpose or expected benefits	OBJECTIVE 1-Share Resources 2-Co-benefits 3-Ecosystem 4-Service Provision 5-Avoid Bureaucracy 6-Share Information 7-Others

Factors	Framework Description	Research Question	Description	Coding Scheme
1. Shared Motivation	Trust, mutual understanding, internal legitimacy, commitment (Emerson & Nabatchi, 2015)	Q.3. What are the reasons for collaborating? Is there clarity of purpose for collaboration? (<i>same as OUTCOME</i>) (<i>same as Consequential Incentives, above</i>)	Goals, purpose or expected benefits (<i>same as Consequential Incentives, above</i>)	OBJECTIVE 1-Share Resources 2-Co-benefits 3-Ecosystem 4-Service Provision 5-Avoid Bureaucracy 6-Share Information 7-Others (<i>same as Consequential Incentives, above</i>)
2. Capacity for Joint Action	- Procedural and institutional arrangements, leadership, resources, knowledge (Emerson & Nabatchi, 2015); - Transparency of process (Dietz & Stern, 2008)	Q.5. What tools and mechanisms are used to collaborate?	Means by which collaboration is accomplished (Henstra, 2015)	MEANS 1-Human Resources 2-Infrastructure 3-Technology 4-Financial 5-Leadership 6-Regulatory 7-Information Sharing 8-Resources (Other)
III. ACTIONS				
	- Steps taken to attain target goal and achieve common purpose (process) (Emerson & Nabatchi, 2015); - Commitment to use the process to inform their actions (Dietz & Stern, 2008)	Q.6a. What types of actions are taken to achieve collaborative goal?	Are actions specific or broad (EOP, 2014)	TOOLS 1- Broad-Action 2- Specific-Action 3-Others
	- Steps taken to attain target goal and achieve common purpose (process) (Emerson & Nabatchi, 2015);	Q.6b. What is the timeframe of action?	Length of initiatives, commitment for long term partnerships	TIMEFRAME 1-Long (more than 10yrs) 2-Medium (5 to 10yrs) 3-Short (less than 5yrs) 4-Not Mentioned

Factors	Framework Description	Research Question	Description	Coding Scheme
IV. PARTICIPANTS	<p><i>Public Participation:</i></p> <ul style="list-style-type: none"> - stakeholders, affected public, observing public, general public (Dietz & Stern, 2008) <p><i>Plan Quality Evaluation:</i></p> <ul style="list-style-type: none"> - Inter-Organizational Coordination - Participation (Berke, Smith, & Lyles, 2012; Lyles, Berke, & Smith, 2014) 	Q.7a. Who is involved in the action?	- List of potential participants (EOP, 2010, 2014);	STAKEHOLDERS 1-Federal govt. 2-Local govt. 3-Regional govt. 4-Tribal 5-Interagency 6-International 7-Non-governmental 8-Private 9-Academia 10-Vulnerable communities 11-Public (<i>including community</i>) 12-Others
V. OUTCOMES	<ul style="list-style-type: none"> - Actors involved at all stages of decision-making (Dietz & Stern, 2008) - Consequences (physical, environmental, social, economic, political, and/or cultural) (Emerson & Nabatchi, 2015); - clarity of purpose (Dietz & Stern, 2008) 	Q.7b. What stage of planning is the action taken in?	Different stages of the policy cycle	STAGE 1-Planning 2-Prioritize Strategy 3-Decision Making 4-Implementation 5-Evaluation 6-Feedback 7-Other
VI. MALADAPTATION	<ul style="list-style-type: none"> - Recognize and takes steps to reduce negative spillovers (Adger, Arnell, & Tompkins, 2005). 	Q.3. What are the reasons for collaborating? Is there clarity of purpose for collaboration? (<i>same as OUTCOME</i>) (<i>same as Consequential Incentives, above</i>)	Goals, purpose or expected benefits (<i>same as Consequential Incentives, above</i>)	OBJECTIVE 1-Share Resources 2-Co-benefits 3-Ecosystem 4-Service Provision 5-Avoid Bureaucracy 6-Share Information 7-Others (<i>same as Consequential Incentives, above</i>)
		Q.8. Is there recognition of potential maladaptation? Are there strategies to prevent maladaptation?	Discuss, recognize or plan for unforeseen effects	NEGATIVE 1- Mention-MAcpt 2-Strategy-MAcpt

The CGR Framework can be divided into five broad components – i) the system context and drivers, ii) collaborative dynamics, iii) collaborative action, iv) outcomes, and v) adaptation. Each of these components have sub-parts, and are explained below.

I. SYSTEM CONTEXT AND DRIVERS: The system context is the broad external circumstances which provide a background within which collaboration may emerge. These include socioeconomic, political and environmental characteristics surrounding an issue, and can create motivations or constraints on how and what types of collaborations might emerge. The system context gives rise to four drivers that are a catalyst for cross-boundary collaboration. These drivers are - uncertainty, interdependence, consequential incentives and initiating leadership. Drivers for collaboration can present themselves in varying degrees and work in combinations among themselves to reinforce different patterns of participation and partnerships.

a. Uncertainty: captures the challenge of problems where the policy solutions are not clearly available or are disputed. Such ‘wicked problems’ are surrounded with ambiguity on the causes of the problem, limited information and resources, and have a high degree of uncertainty. Such situations may drive organizations to work together to decrease risk and result in the formation of partnerships (Emerson & Nabatchi, 2015).

Literature on collaboration discusses that collaboration is more likely to emerge when the problem is more severe or salient (Sabatier et al., 2005), leading to more willingness on the part of governments to come together with other agencies and actors. The public participation studies mention tailoring the participants to the ‘context’ of the problem (Dietz & Stern, 2008). Another way of exploring the context is by understanding the definition of the policy problem, and how this description is discussed in actual planning documents. For example, do plans discuss the

heterogeneity of climate impacts across boundaries requiring collaboration, or are impacts and risks discussed within specific sector boundaries. Combining these ideas I ask:

***Question1:** Do the descriptions of climate change impacts in the plans mention the need for collaboration for successful adaptation?*

b. Interdependence: For effective implementation, strategies for adaptation may overlap across agency boundaries. Interdependence is described as the mutual reliance of organizations and individuals to achieve a goal they cannot accomplish on their own (Emerson & Nabatchi, 2015). With the rise in complexity of problems, governments are more likely to partner with other agencies, private sector and organizations to ‘do what they alone cannot do’ (Agranoff, 2003).

For this driver, I mainly focus on cross-sectoral collaboration. I examine collaboration cross other stakeholders in another component of the framework (Actions). Within climate adaptation, various international and national frameworks recommend inter-organizational collaboration (EOP, 2014; UNDP, 2005), but do not point to any groups or pairs of agency sectors that maybe more likely to work together. We know little about patterns or trends in sectors working together to build resilience.

***Question2:** Which agency sectors are more likely to collaborate and work with one another? Are there any patterns for partnerships developed?*

c. Consequential Incentives: Incentives can be the motivation to collaborate. These can be in the form of internal pressures within an organization such as resource needs, interests, opportunities, or external pressures such as situational crisis, threats and opportunities that are better addressed by working with other groups (Emerson & Nabatchi, 2015). These incentives can also be closely connected with the goal or purpose of the partnership – what are the reasons for the groups to work together, what they hope to achieve.

The public participation theory recommends that when government agencies employ public participation, they should do so with clarity of goal or objective (Dietz & Stern, 2008). Groups may come together to share resources, gain co-benefits, or provide joint services to the public. Transparency of objectives for collaboration can be beneficial for successful implementation and monitoring of strategies.

***Question3:** What are the reasons or goals for coming together in collaboration? Is there clarity of purpose of collaboration?*

d. Initiating Leadership: The CGR framework focuses on a type of leadership – ‘initiating leadership’ as an important and often essential driver for collaborative partnerships. This leadership plays a role in bringing the players together, as well as serves to control and maintain collaborations in the long run (Emerson & Nabatchi, 2015). While these characteristics are essential, they are not always apparent in planning documents.

For this reason, I tailor leadership to include a broader description of the values and opinions of the policymakers of the adaptation plan. Policymakers or leaders within the government agency have influence over how the issue is framed, and the inclusion and salience

of ways the problem and solutions are discussed (Preston et al., 2009). I assess this in three ways – whether there is a lead entity overseeing collaboration, whether collaboration is framed as necessary and essential, and the importance given to collaboration within the actual plan document.

***Question4a:** Is there a leader to oversee the collaborative efforts? Is there description of the distribution of power among the collaborating parties?*

***Question4b:** How do the policymakers frame collaboration within the plans?*

***Question4c:** What is the importance given to collaboration within the larger context of the adaptation plan?*

II. COLLABORATION DYNAMICS: The process of collaboration can be discussed in a linear fashion with a sequence of steps that are commonly discussed in traditional public policy theories. But similar to contemporary policy theories that propose more dynamic depiction of the real world, the CGR's collaborative dynamics is circular and iterative. This piece of the framework focuses more on the process side of governance, and describes how participants in collaboration develop shared goals and strategies over the long term (Emerson & Nabatchi, 2015).

Collaborative dynamics have three components – principled engagement, shared motivation and joint capacity.

a. Principled Engagement: ‘principled’ of the term principled engagement refers to the underlying assumption on which the participants engage in collaboration. It can be understood as how actors with different opinions, values and experiences unite around a shared understanding. This includes discovery (sharing concerns, values, information), definition (shared meaning and understanding of the problem and its solutions), deliberation (meaningful discussion to reach consensus), and determinations (reaching a joint conclusion) (Emerson & Nabatchi, 2015).

While each of the parts for principled engagement has merit for in-depth analysis, clear distinction of these may not be apparent in a planning document. For this reason, I combine these measures and focus on principled engagement as a common understanding on the problem and solutions among participants. This criterion however overlaps with the operationalization of ‘uncertainty’, and I do not code separately for the same (same as Research Question 1).

b. Shared Motivation: describes the interpersonal relationships between participants, which is measured in terms of trust, mutual understanding, internal legitimacy, and commitment (Emerson & Nabatchi, 2015). Given the nature of this study, evaluating levels of trust is not feasible through planning documents. Instead, I focus on the broader concepts of a shared understanding between stakeholders. This concept overlaps with ‘Consequential Incentives’ which measures the purpose or reasons for collaboration. No new code is created to measure shared motivation (same as Research Question 3).

c. Capacity for Joint Action: is the functional aspect of the framework which describes the formal and informal institutional arrangements, protocols, and ways resources and knowledge will be shared among participants (Emerson & Nabatchi, 2015). These arrangements illuminate details on the means by which various collaborative strategies will be implemented.

Scholars within the field of public participation recommend transparency of these processes (Dietz & Stern, 2008) as an important principle for equity and legitimacy. The procedural and institutional elements have also been mentioned within discourses on policy instrument selection. It is important to have clarity on the means and ways participants envision collaboration will be achieved through the duration of partnership. I operationalize this ‘capacity for joint action’ through tools and mechanisms through which collaboration is achieved. These include, and are not limited to, sharing knowledge, human resources, infrastructure facilities, or technology equipment, and creating regulatory arrangements, or rules for leadership and communication (Henstra, 2015).

Question 5: What tools and mechanisms are used to collaborate?

III. ACTIONS: Through the iterative interactions between the components of collaborative dynamics mentioned above, participants prioritize and select activities through which they plan to achieve their goals set within the partnership agreements. They are ‘means to an end’ to accomplish what the stakeholders mutually agreed upon (Emerson & Nabatchi, 2015).

Collaborative action may take different forms, depending on the context of the policy domain and the decisions reached among the participants. For example, action could be based on functional criteria such as capacity building or resource generation (Agranoff, 2003). The components of ‘Capacity for Joint Action’ and ‘Actions’ are closely related but not identical. Capacity-for-Joint-Action is the means through which action strategies will be implemented and achieved. As the name suggests, ‘capacity’ points to the ability and ways stakeholders plan to accomplish desired action.

In the context of climate change, actions could be broad like building resilience, reducing GHG emissions; or more specific like establishing a Clearinghouse to gather and distribute climate information, create Task Forces and new institutions to investigate climate impacts, and policy advocacy for raising funds (EOP, 2014). Since the range of initiatives is expected to vary widely across plans, I use a more open ended code to distinguish between broad and specific measures. I also examine the length and duration of these collaborative actions.

Question 6a: What types of actions are taken to achieve collaboration goals?

Question 6b: What is the timeframe for collaborative action? Is there discussion for long-term partnerships?

IV. PARTICIPATION: CGR as a framework provides a practical structure to assess the different moving parts within collaborative governance. While this is useful and I apply the components in my Analysis-Framework, the structure is limited in capturing the agency or types of actors within the system. For example, the aspect of leadership is discussed as one of the four drivers for collaboration, but there is inadequate understanding on which actors take on leadership. Similarly, while we know about the actions implemented in collaboration, we know little about the actual participants in these teams.

It is here that the standards for Public Participation and principles for Plan Quality Evaluation are helpful to highlight the types and diversity of actors. As discussed in the theory section of this chapter, public participation should be incorporated in policy decision-making to allow for representation of various stakeholders (democratic and normative aspects) and

effectiveness of policy implementation (practical aspects) (Dietz & Stern, 2008). My CIA Framework has integrated various recommended standards of public participation from literature into different components of the CGR framework. These include diagnosis of the context of the policy problem within ‘Uncertainty’; clarity of purpose within ‘Consequential Incentives’; and transparency of process within ‘Capacity for Joint Action’. In this component on ‘Participation’ I bring in standards of who should be involved in collaborative governance.

The U.S. National Research Council recommends involvement of public to include the key stakeholders (organized groups affected by the policy decision), the affected public (expected to experience positive/negative effects from outcome or policy problem), the observing public (media, opinion leaders), and the general public (not directly affected or part of public opinion) (Dietz & Stern, 2008; pp.15). I operationalize this recommendation to test for each of the above groups and code for the private sector such as the manufacturing industry and insurance companies (stakeholders), the vulnerable communities as identified through climate assessments (affected public), researchers and academia (observing public) and the local community (general public).

However climate adaptation policies necessitate the involvement of different stakeholders as well as inter-agency and cross-boundary partnerships in a federalist system (EOP, 2014). The Plan Quality Evaluation Principle-5 aims to capture just that. The standards for Inter-Organizational Coordination help explore government authorities’ working across jurisdictional borders, either through vertical partnerships such as between federal, state and local authorities, or creating horizontal ties between agencies across sectors on the same level of government. In addition to these recommendations, I also code for partnerships with the tribal governments, and span across regional and international organizations.

Public participation theories also highlight involving stakeholders at all stages of decision-making (Dietz & Stern, 2008) and I test the same with respect to stages of the policy cycle that result in collaborations among the different actors.

Question 7a: Who is involved in the action?

Question 7b: What stage of planning is the action taken in?

V. OUTCOMES: The purpose of collaboration is the intended goal or outcome the participants aim to achieve. These are objectives that different actors come together on, and decide through thorough deliberation and representation (as discussed above). These intended benefits can be viewed as the yardstick against which policymakers and stakeholders design and implement strategies (Emerson & Nabatchi, 2015). Since the intent and operationalization of this component overlaps with ‘Consequential Incentives’, I do not create separate codes for Outcomes (Same as Research Question 3).

VI. MALADAPTATION: Incoherence among policy instruments can result in unintended negative impacts on different sectors or groups of people (Henstra, 2015). Maladaptation can result from the spill-over of initiatives implemented within water-tight agency jurisdictions that do not consider broader implications of the activities. Scholars have documented various case studies where well-intended government policies resulted in maladaptation (Adger et al., 2005). In order to cater for this, I have created a code that will explore if the plan document mentions or discusses potential maladaptation of policy goals, as well as suggestions of ways to avoid the same.

Question 8: Is there recognition of potential maladaptation? Are there strategies to prevent maladaptation?

3.5. APPLICATION OF FRAMEWORK – PRELIMINARY TEST

My *Collaboration-In-Adaptation* (CIA) Framework has many components that can be tested on various adaptation plans at different levels of government. While the main purpose of this chapter is to develop the framework, I conduct a preliminary test to assess how well the codes developed can be applied to the planning documents. The purpose of this application is not to propose any definitive results, and the findings are presented as a mere indication of emerging patterns. I also present examples to illustrate how the codes perform in practice.

METHOD: I apply the CIA to four State Adaptation Plans. These states are purposefully selected to provide a variation on geographic locations as well as the number of goals set. As mentioned earlier, the goals set by the states are an indication of the level of commitment by policymakers to tackle the problem (Georgetown Climate Center, 2015). I divide the goals into four categories – states with less than 50 goals, states with 50 to 100 goals, 100 to 200 goals, and finally those with more than 200 (See Figure 3.1, which describes State with adaptation policies). From these groups I make my selection of states from the Eastern, Central, and Western Regions. The sample includes Florida, Colorado, Alaska and Massachusetts (See Table 3.2 for details).

Table 3.2: Sample of States Selected for Preliminary Test of CIA Framework

State	Goals	Location
Florida	28 (Less than 50)	South-East
Colorado	72 (Between 50 to 100)	Central
Alaska	158 (Between 100 to 200)	West + High Tribal Population
Massachusetts	373 (More than 200)	East

I take the adaptation planning document for each of these states and apply the CIA framework. The coding strategy applied is a free sentence coding approach where quotations or paragraphs of text are selected based on their relevance in discussing collaboration within the framework's concepts (Krippendorff 2004). This process applies codes to a paragraphs or parts of a paragraph for the four documents. It must be noted that a single quotation of text can be given multiple codes. I use Atlas.ti (version 7) qualitative analysis software to code and analyze my findings.

RESULTS: The framework has many broad concepts that can each be investigated in-depth. However, for the purpose of this preliminary test I present results and examples on two main questions – which sectors are more likely to collaborate, and which participants are more involved in the collaboration.

A. Interdependence (Inter-Agency Collaboration): To assess which sectors are more likely to collaborate with one another, I aggregate the codes of each sector that appear together within a quotation. For example:

“Another important set of cross-cutting strategies identified during the development of this report include measures that preserve, protect, and restore natural habitats and the hydrology of watersheds. These strategies not only benefit natural resources and habitat, but can also play a critical role in protecting and increasing resilience of key infrastructure sectors, human health, and the local economy.” (Massachusetts Climate Change Adaptation Report, 2011; pp.3)

This quotation was given sector codes for biodiversity, infrastructure, health and others (‘others’ representing local economy). Another example to explain the coding procedure:

“Water quality and water quantity are inextricably connected; both are vital for Colorado’s future. Managing both conjunctively is important for the continuation of the state’s healthy environment, diverse economy, and quality of life. It is not sufficient just to have enough water, but that water also has to be of high enough quality for the many

ways Coloradans use it, from drinking and wildlife protection to agriculture and recreation. This is especially true given climate projections that include potential water quality impacts on Colorado’s water supply.” (Colorado Climate Preparedness Project, 2011; pp.11)

This text was given sector codes for water, biodiversity, agriculture and other (for recreation/tourism). The results of this coding procedure for all four adaptation plans are summarized in Table 3.3 below.

Table 3.3: Preliminary Results – Frequency of Cross-Sector Collaborations for Four Sample States

EPA SECTORS	Agriculture	Biodiversity	Coasts	Forestry	Emergency	Health	Infrastructure	Water	Others	Mitigation	TOTALS
Agriculture	0	7	0	0	0	2	4	13	10	4	40
Biodiversity	7	0	6	4	2	11	14	14	11	15	84
Coasts	0	6	0	0	0	4	4	3	1	4	22
Forestry	0	4	0	0	0	1	2	1	4	2	14
Emergency	0	2	0	0	0	6	2	4	2	1	17
Health	2	11	4	1	6	0	16	5	7	21	73
Infrastructure	4	14	4	2	2	16	0	12	10	18	82
Water	13	14	3	1	4	5	12	0	9	8	69
Others	10	11	1	4	2	7	10	9	0	15	69
Mitigation	4	15	4	2	1	21	18	8	15	0	88

Note: Tables results presented for 4 States: Alaska, Florida, Colorado and Massachusetts, using Atlas.ti

The table provides an overview discussion within the planning documents that discussed collaboration and cut across agency boundaries. The numbers represent the frequency of mention across the plans, with those in bold highlight the highest rate of recurrence. I find that co-benefits of mitigation strategies with positive spill-over in the health, infrastructure, and biodiversity sector appear the most frequently among plans. This could be an indication that policymakers tend to maximize low-hanging fruits and co-benefits between adaptation and mitigation. These

preliminary findings are in line with previous research on adaptation plan evaluation that suggest prominence of low-risk and co-benefit strategies (Woodruff & Stults, 2016; Bierbaum et al, 2013; Preston et al., 2011; Poyar, 2010). In terms of interagency collaboration, I find the health and infrastructure sectors most prominent, followed closely by partnerships between the agriculture and water sector.

B. Participation (Collaboration Participants): This code identifies the diversity of stakeholders and actors involved in the collaborative arrangement. For example, the quotation below received stakeholder codes for the federal government, local government, academia and community:

“Create/designate an Immediate Action Work Group (IAWG)-like entity to assume a coordinating role now. We recommend this group be permanent and be action-oriented, focusing on aligning and coordinating (not regulating) decisions. Impacted and potentially impacted communities, agency funders, and researchers frequently do not know about each other’s planning efforts, infrastructure improvement projects, or funding opportunities. The proposed entity is needed to coordinate communication horizontally among partner agencies and vertically among levels of government and other stakeholders. It will streamline processes, eliminate duplicate efforts, minimize unnecessary effort, and minimize transaction costs of developing and carrying out a statewide system. A State of Alaska Executive Order is likely needed to establish this entity or structure. A senior-level executive should be manager. Implementation will be through existing agencies and authorities.” (Alaska’s Climate Change Strategy, 2010; pp.4-9)

Another example on stakeholders received codes academia (which includes researchers and experts) and the state government agency.

“Planning for climate change in Colorado is particularly challenging because the projections of future conditions range significantly. To better understand the potential risks and challenges, Denver Water directly engages with climate scientists to “co-produce” the data, tools, and methods needed to incorporate climate change into their planning. These collaborations keep Denver Water at the forefront of climate science while providing critical feedback and encouraging climate scientists to better meet decision-making needs.” (Colorado Climate Preparedness Project, 2011; pp.76)

Table 3.4: Preliminary Results – Frequency of Collaborations Among Different Stakeholders for Four Sample States

STAKEHOLDER COLLABORATIONS WITH STATE GOVT.	FREQUENCY
Federal	68
Local	75
Tribal	28
Regional	19
International	5
NGO	43
Private	64
Academia	44
Vulnerable	7
Community	45

Note: Tables results presented for 4 States: Alaska, Florida, Colorado and Massachusetts, using Atlas.ti

Table 3.4 presents the different collaborative participants with state government agencies. As expected, these preliminary finding suggest potentially strong ties among state and local governments in implementing adaptation strategies. State governments also seem to consult and partner with the federal government implying a likelihood of healthy vertical collaboration across different levels of government.

Among non-governmental stakeholders, the private sector seems to be the most frequently involved, and at a relatively higher rate than the local community. A further investigation into the goals for collaboration, types of tools and mechanism applied, and the policy stages of involvement would better explain the differences in quality of collaborations between the private sector and local community. Such insights would build on public participation and environmental justice scholarships.

3.6. CONCLUSION AND WAY FORWARD

Collaboration is necessary for successful adaptation planning. Climate change is a ‘wicked’ problem, involving complex scientific and technical knowledge, as well as high levels of complexity. Impacts of extreme weather events, sea level rise, and changing temperatures resulting from climate change are spread across geographic boundaries that are beyond typical judicial and political borders. Effective policy measures and strategies would need to cross government agencies, and involve various stakeholders and organizations.

While international and national frameworks on adaptation continue to stress the need for collaboration and coordination, there is limited analysis on whether these standards are actually applied within existing plans. Previous studies on adaptation plans are predominantly case study analysis (Preston et al., 2011; Poyar, 2010), or only assess collaboration and participation on the surface (Woodruff & Stults, 2016; Bierbaum et al., 2013). There is little understanding about the quality of collaboration such as the types of collaborative goals set, tools and mechanisms applied, stage of participant involvement, and power and access differences among stakeholders.

It is pertinent to uncover these answers. My chapter addresses many of these questions through the development of an analysis framework, which I call *Collaboration-in-Adaptation (CIA)*. My framework modifies the ‘Collaborative Governance Regimes’ framework, that is designed for application across broad policy areas. The CGR framework provides structural aspects of collaboration, but lacks a clear focus on agency and actors that participate in partnerships. To fill this gap I incorporate elements from public participation theory and inter-organizational coordination from plan quality theories. The CIA framework is also specifically tailored to climate adaptation.

Way Forward: The results in this chapter are preliminary, and indicative of ways the CIA framework maybe applied to explore different research questions on collaboration. My results are limited due to the lack of inter-coder reliability, a requirement for vigorous content analysis and qualitative methodology of this kind. Never the less, efforts to create a robust framework on collaboration in adaptation is an important contribution to literature, on which my future research will be developed.

Moving forward, I anticipate ‘collaborating’ with a team of researchers and applying my framework across all the 14 state adaptation plans. There are also benefits in exploring differences in collaborative pattern across plans across levels of government, and expanding the framework application to federal, tribal and local governments. Further, these studies can be augmented with in-depth interviews and surveys with different stakeholders to triangulate findings.

CONCLUSION

The politics of climate adaptation is an understudied area in the field of political science (Javeline, 2014). Scientists have warned that even if global emissions are drastically reduced, given the accumulation of emissions already in the atmosphere, there will be adverse impacts from climate change (IPCC, 2015). With these projections, governments and communities will need to take some level of adaptation measures to prepare for the inevitable consequences of changing climates. Despite the gravity of the risks from climate change, comprehensive federal action on building resilience has been slow. Within this federal void, much like sub-national environmental policymaking in the United States, it is states and local governments who are taking the lead (Rabe, 2008).

Growing adaptation commitment and initiatives by state and local governments demands a greater understanding of the sub-national politics surrounding the issue. In this dissertation, I explore three broad themes within the research agenda of sub-national climate adaptation – analysis of the predictors for the emergence of State Adaptation Plans (SAPs); understanding the urban politics around city level commitment to build resilience; and a deeper investigation into collaboration within adaptation planning. Each of these themes was presented in a separate chapter and I briefly present the main findings.

Chapter-1 explores the state politics of adaptation. I apply the Diffusion of Innovation (DOI) theory on two dependent variables (DVs) – a dichotomous (yes/no) for policy adoption, and a more complex dependent variable that captures the ambitiousness of goals set within these SAPs. Using a more intricate DV allows for differencing between ‘shallow’ and ‘deep’ commitment by policymakers (Berry & Berry 2007).

I find differences between predictors that influence policy adoption and policy ambitiousness. While state vulnerabilities and economic capacity matter in both cases, states are motivated to prepare ambitious SAPs when they face greater threats of climate impacts and pressures from environmental interest groups. On the other hand, citizen ideologies and previous mitigation policy experience are more influential in policy adoption. These findings shed light on the theoretical under-pinning's of the DOI theory, and the need for policy analysis using more complex dependent variables. Dependent variables that capture more detailed dimensions of policy adoption have the potential to capture finer information on predictors of importance.

I also explore conditional effects of state government ideologies and the severity of the problem, another concept not considered among adaptation studies. The results suggest that while as an independent predictor government ideology did not have a strong effect on SAPs, when examined from the conditional perspective, both conservative and liberal state institutions were likely to respond to increasing problem severity by adopting adaptation strategies. These findings are interesting and advance our understanding both theoretically and substantively.

Chaper-2 examines urban politics and finds interesting patterns among commitment by local governments to build resilience and adapt to climate change. Applying the DOI theory to a relatively untested unit of analysis (cities), results suggest that neither state level characteristics and state policy experience, nor pressures from behavior of neighboring cities have a bearing on local policymakers. I also examine variations among city size, and shed light on an area not previously discussed in adaptation research. Interestingly, smaller cities respond differently to local factors than larger cities. Studies on sustainability policy have indicated that smaller cities lack the capacity and resources and have lagged behind in policy development (Portney, 2009). With a better indication of the likely factors that support or suppress adaptation planning among

small cities, this outcome can be different. It is encouraging to see that the presence of environmental groups is a strong catalyst in policy development.

Lastly, in Chapter-3, I delve deeper into the issue of climate adaptation and collaborative governance within State Adaptation Plans (SAPs). Prominent national and international frameworks on adaptation planning stress the need for collaboration among different levels of government and various stakeholders for successful adaptation. When examining collaboration literature, I find that previous studies examining adaptation plans either do not evaluate the plans for collaboration and participation (Preston et al., 2011; Poyar, 2010); or those that do mainly provide a list of stakeholders without a deeper analysis of these partnerships (Woodruff & Stults, 2016; Bierbaum et al, 2013). There is little understanding about the quality of collaboration such as the types of collaborative goals set, tools and mechanisms applied, stage of participant involvement, and power and access differences among stakeholders.

This chapter develops a framework to adequately respond to these multiple questions on collaboration, which I call *Collaboration-in-Adaptation (CIA)*. I modify the *Collaborative Governance Regime (CGR) Framework* by Emerson & Nabatchi (2015) which is effective in providing the structural aspects of collaboration, but lacks a clear focus on agency and actors that participate in partnerships. To fill this gap I incorporate elements from public participation theory, and inter-organizational coordination from plan quality theories. The CIA framework is also specifically tailored to climate adaptation. This framework can be applied to various levels of governance and is an important contribution to evaluating the quality of adaptation plans.

Broader Implications: The results from the dissertation are useful for policymakers, interest groups, non-governmental organizations, private sector and other agencies. Among state policymakers, conservative government institutions are likely to take action to build resilience

only when the severity of the problem is high. While on one hand it may seem positive that governments are responding to the intensity of the problem, in the context of climate change, this could be worrying. Studies also show that reactive adaptation (action after impacts occur) are more likely to result in exacerbating vulnerabilities, while anticipatory action (in preparation of exposure) reduce harmful impacts and facilitate recovery in the aftermath period (Adger et al., 2005).

Moreover, the carbon intensive industries, similar to climate mitigation, seem to exert strong opposing pressure for adaptation policies on both state and local governments. This oppositional force can be a hindrance for policy adoption, and governments could benefit from designing policy tools that provide financial and technical incentives to reduce the possible threats felt by this group of actors. For example, countries in Europe like Denmark, Sweden, France and Germany have developed innovative policy tools that create market incentives and support for carbon industries to switch to cleaner fuels and less polluting technologies (World Energy Council, 2016).

In addition, state policies on adaptation are not likely to have a significant influence on local government policy making. This may mean that in order for us to see more proactive and comprehensive local planning, direct encouragement from higher government institutions could be necessary. Perhaps more explicit positive incentives such as grants and resource sharing or more negative carrot-and-stick approach with enforcement threats or penalties maybe required. Further, technical and financial support for better adaptation planning is suggested to help smaller cities prepare for resilience. Smaller cities usually lack resources, and given their vulnerabilities to climate change, greater backing by the federal and state governments could propel an increase in planning for resilience communities.

Way Forward: This dissertation is among the first large scale quantitative investigations of sub-national adaptation politics. While the results are interesting, these findings necessitate further investigation into this contemporary issue. First, there is a need for better indicators in the model to capture the severity of climate change. Existing measures capture human and property loss to current climate impacts, but do not incorporate anticipated or future effects. Measures that include both current and future projects of the negative consequences from climate change will be beneficial.

There is also scope to expand my results from the cities chapter by developing better dependent variables to explore policy adoption and policy ambitiousness, as well as expand the study from a cross-sectional analysis to panel data spanning a longer period of time. Further, preliminary findings suggest interesting patterns among the interest group pressures and forms of government, and it would be useful to expand the investigation by testing conditional effects from factors.

Moving ahead, my CIA framework can be applied to explore different research questions on collaboration. The structure proposed in this work has multiple dimensions of collaboration that can be delved into for deeper investigation. The framework can also be applied to understand collaborative patterns across plans developed by different levels of government like the federal, tribal and local governments. Further, these studies can be augmented with in-depth interviews and surveys with different stakeholders to triangulate findings. Climate adaptation is a relatively untested area of research, and demands deeper exploration on the politics surrounding it.

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