Environmental Harm or Natural Hazard? Problem Identification and Adaptation in U.S. Municipal Climate Action Plans

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Abstract

*A number of cities in the United States have devised climate action plans (CAPs) to mitigate the effects of climate change. However, few of these plans address strategies to adapt to the long term effects of climate change that will occur in the near and distant future. The research presented in this article examines why cities choose to embed adaptation provisions in their CAPs. Our study codes the content of CAPs for all cities (*N = *98) in the United States with populations greater than 50,000. We find cities that frame problems associated with climate change in the language of hazards are more likely to include adaptation strategies in their CAPs than cities that focus on other types of environmental harm. Our findings suggest that more robust efforts to plan for climate change will require the activation of communities of interest beyond those that have been instrumental in setting the current climate agenda.*

KEY WORDS: climate change, climate action planning, adaptation, environmental framing, environment, urban studies, disaster & risk management, municipal, municipality, climate action plans, cities, mitigation

Introduction

Faced with the challenge of climate change, many governments have developed coordinated efforts that attempt to reduce the flow of greenhouse gasses (GHGs) into the atmosphere to mitigate human contributions to climate change. Irrespective of these policies, governments must also plan for the consequences of climate change into the future—a planning pattern characterized as adaptation (see Javeline, 2014, for an overview). Examples of adaptation include Seattle's plans for increased water scarcity; New York City's sea wall to prepare for sea level rise and increased storm surge; Portland, Oregon's plans to confront climate-induced migration ("climate refugees") that will result from shrinking resources in more populous parts of the American Southwest; and Chicago's plans to tackle urban heat by providing shade over paved spaces and an awareness of heat-vulnerable populations.

Despite a lack of federal policy, U.S. cities are planning for these and other effects of a warming climate (Rogelj, Meinshausen, & Knutti, 2012)—yet these realities are generally not a part of most climate-related policy (Bierbaum et al., 2013). Until very recently, most human efforts to adapt to climate change have come from the uncoordinated collective efforts of individuals to cope with increased heat and changes in weather patterns. This is in stark contrast to coordinated efforts to develop climate action plans to produce energy from renewable sources; to mandate building efficiency; offset carbon emissions directly through tree planting and indirectly through

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participation in global networks; and propose more efficient transportation options through fuel sources, urban planning, and transit (see Fitzgerald, 2010).

Policy scholarship has yet to broadly investigate efforts to address climate adaptation, in part because policies are highly localized. Javeline (2014) boldly suggests that climate adaptation is one of the most understudied areas in public policy and political science (see, however, Rosenzweig & Solecki, 2014; Rosenzweig et al., 2011). The research presented in this article seeks to fill this gap in the literature and answer the basic question: To what extent are cities considering adaptation when planning for climate change? In addition, we ask: What are the determinants of adaptation planning in climate action plans?

The extant literature on environmental policy suggests that planning for adaptation may be a function of how the problem of climate change is framed (Fünfgeld & McEvoy, 2014; Rickards, Ison, Fünfgeld, & Wiseman, 2014). Early discussions of climate change centered on understanding global warming in terms of GHG generation and early solutions often responded in the language of environmental harms—such as air pollution and changes in ecosystems. However, efforts to adapt to changing climactic conditions are cast more broadly in the language of hazards—such as sea level rise, extreme storms, and community resilience. Climate change adaptation, thus, is driven less by the mass politics of environmental harms and more the "board room" politics of expertise about public risks (Gormley, 1986; Kunreuther, 2006)

Most city-level climate change policy in the United States comes in the form of "Climate Action Plans" (CAPs). Climate action plans are planning documents that have few binding requirements, but nonetheless act as policy due to their function as guiding documents for decision makers regarding climate change. For example, CAPs contain a wide range of efforts to address the emission of greenhouse gasses from transport, residential, and commercial usage as well as a number of other environmental goals such as local food production and sustainability of current resource consumption. Climate action plans are the result of political processes that involve the intersection of different communities of interest, climate expertise, and governance structures. Climate action planning has been well studied by scholars in environmental (Bulkeley & Betsill, 2013; Pitt & Randolph, 2009) and local governance literatures (Hopkins, 2012; While & Whitehead, 2013), with the vast majority of research focus centered on mitigation (Lee & Koski, 2012; Sharp, Daley, & Lynch, 2011).

Our study draws upon a census of all municipal CAPs in the United States to identify the extent of adaptation efforts in the context of a city's overall climate change policy. We derive our data from lists provided by associations that promote climate action planning (the International Council for Local Environmental Initiatives and the U.S. Conference of Mayors Climate Protection Agreement), the Environmental Protection Agency, and from a secondary search of all websites of all cities with populations greater than 50,000 citizens for climate action planning documents. The resulting dataset allows for the broadest examination of adaptation efforts at the local level in current scholarship. We find CAPs that use the language of "hazards" in describing climate change problems have a more extensive focus on adaptation than those that focus on the traditional language of environmental harms. We conclude by arguing that cities typically resistant to climate change policies because of ideology or location may still be able to address climate change with an "adaptation first" strategy.[1]

Treating the Cause of Climate Change: Mitigation

Over the past decade, there has been a burgeoning literature surrounding city-level responses to mitigating climate change (Krause, 2011b, 2012a; Lee, 2013; Lee & Koski, 2012; Lee & van de Meene, 2013). Subnational scholarly attention was first devoted to state efforts to control greenhouse gasses largely via energy production efforts, carbon sequestration, more efficient energy distribution, and transportation (Carley, 2011, 2012). Cities have become the focus of climate scholars for a variety of reasons: they contain large portions of the world's population in concentrated political units and are the source of much of the world's onsite and offsite GHG production (Dodman, 2009). In 1993, Portland, Oregon became the first city in the United States to adopt a municipal greenhouse gas reduction plan (Rutland & Aylett, 2008). Subsequent climate action plans in the United States similarly contain provisions related to mitigating the effects of climate change via planning that reduces the production of greenhouse gasses in areas such as transportation, building efficiency, and smart-growth zoning.

Cities learn from their own stakeholders when drawing up CAPs (Bond, 2009; Engel, 2006; Rabe, 2008), but often are also informed by the national and international agreements to which they are signatories (Betsill & Bulkeley, 2004, 2006; Lindseth, 2004; Per-Olof, Jorgens, & Tews, 2005). The literature on climate mitigation policy focuses largely on the role of city-level mitigation as a "bottom-up" strategy for addressing climate change and its determinants (Brody, Grover, Lindquist, & Vedlitz, 2010; Lutsey & Sperling, 2008; S. M. Wheeler, 2008). Other more traditional political factors such as ideology, presence of green manufacturing, carbon-heavy manufacturing, and proximity to climate-change harm are also found to be influential over these decisions (Betsill, 2001; Krause, 2011a, 2011b).

Treating the Symptoms of Climate Change: Adaptation

In stark contrast to addressing the causes of climate change, adaptation is currently a "nascent" area of climate action (Millard-Ball, 2013; S. Wheeler, 2010) hitherto examined mostly in single (see: Coffee, Parzen, Wagstaff, & Lewis, 2010; Mastrandrea & Luers, 2012; Rosenzweig et al., 2011) or small N case study (Craft & Howlett, 2013; Evans & Perschel, 2009; Hamin & Gurran, 2009; Henstra, 2012; Tang, Brody, Li, Quinn, & Zhao, 2011). Clearly, the impacts of climate change loom large in the creation of CAPs (Stone, Vargo, & Habeeb, 2012), but there are few academic studies adaptation in CAPs (see, however: Adger et al., 2009; Bassett & Shandas, 2010; EPA, 2013; Hunt & Watkiss, 2011). The environmental policy literature is populated with a number of adaptation case studies on Asian, Australian, and European governments (Biesbroek et al., 2010; Fünfgeld & McEvoy, 2014; Head, 2014; Rickards, Wiseman, Edwards, & Biggs, 2014; VijayaVenkataRaman, Iniyan, & Goic, 2012), but there are fewer North American counterparts (see, however: Biesbroek et al., 2010; Bomberg, 2012; Rayner, McNutt, & Wellstead, 2013; Sovacool & Brown, 2010; Williams & McNutt, 2013).

Certainly there is common ground between mitigation and adaptation efforts (Bond, 2009) and some scholars note that the dichotomy between mitigation and

adaptation is overblown (Moser, 2012). For example, urban areas are prone to exacerbated heat conditions due to a high concentration of impervious surfaces. Given that most impervious surfaces are dark, such as asphalt, cities tend to suffer from hotter conditions. This is a concern of many municipalities because climate change will result in even more extreme summers. Many cities have attempted to create shade via tree planting to adapt to expected weather conditions. Urban afforestation is also a common tactic in mitigation campaigns given the capacity of trees to be long-term CO_2 sinks. Another example of mitigation and adaptation strategies working in tandem are incentives for energy efficient buildings. Energy efficient buildings are likely to reduce carbon emissions, but also to be better insulated from warmer temperatures.

However, there are distinct adaptation strategies that do not promote mitigation—from seawalls, to water conservation/new sources, to outright movement of populations (Coffee et al., 2010; Poyar & Beller-Simms, 2010). Some of these strategies can be contradictory. This part-friction and part-synergy between adaptation and mitigation efforts makes difficult the process of deriving empirically testable hypotheses.

Defining Climate Change as Environmental Harm, Natural Hazard, or Both?

The problems that result from climate change can be viewed through a variety of lenses (Fünfgeld & McEvoy, 2014). Choices in problem definition inherently suggest remedies and activate relevant communities of interest (Entman, 1993; Stone, 2012). Addressing both the *causes* and *effects* of climate change are ostensibly the purpose of climate action plans, but two distinct policy communities have coalesced around these two policy goals. The causes of climate change—namely, the anthropogenic emission of GHGs—largely fall under the political umbrella of reducing the production of environmental harms—e.g., air pollution. Much of the inertia for climate action and specifically CAPs comes in the form of responding to climate change as an environmental harm. Environmental harms are championed by environmental groups and, thus, solutions to climate change are crafted to fit the political desires of the environmental community. However, the effects of climate change—such as sea level rise, increased fire hazards, and lower water availability—are seen as largely affecting human settlement and are more aptly treated as reducing the effects of natural hazards (Rickards, Ison, et al., 2014).

The natural hazards interest community in the United States is traditionally quite different politically from the environmental community—however, these communities are beginning to harmonize as urban planning incorporates both causes and effects of climate change. The natural hazards community serves policies that have broad (or no) defined publics (May, 1992), which leads to expert-driven policy making (May, Koski, & Stramp, 2014). Efforts to address adaptation have been framed by theorists as falling into similar language and solutions of vulnerability, resilience, and risk management (Fünfgeld & McEvoy, 2014; Grove, 2014; Rickards, Wiseman, et al., 2014). The U.S. environmental policy-making community, on the other hand, serves a specific issue public, and is driven by more traditional interest group politics focused upon reducing human impacts upon the environment. Early efforts to address climate change at the local level were framed harmoniously with sustainability, energy efficiency, transport, pollution control,

and so on (Betsill, 2001; Fitzgerald, 2010; Portney, 2003). Thus, the hazards community and the environmental community are likely to emphasize responses to climate change—namely mitigation and adaption—with different fervency.

H1a. A greater focus on the hazards and harms of climate change is likely to lead to a greater focus on adaptation in CAPs.

H1b. Climate action plans that focus on the hazards of climate change over the environmental harms are likely to include more concrete plans for adaptation.

Mazmanian, Jurewitz, and Nelson (2013) argue that environmentalists have traditionally focused on general impacts of climate change. This focus has manifested itself in reliance upon policy guidance from organizations whose primary purpose has been to diagnose sources of climate change (IPCC) and stop it from happening (ICLEI).[2] Environmental groups are more likely to push for mitigation efforts as preferred strategy to address climate change. Adaptation planning falls within a broader category of public risks for which groups of experts such as emergency managers and disaster planners are the dominant drivers of policy problems and solutions (Kunreuther, 2006; Lo, 2013; May & Koski, 2013). Climate change is but one of many factors that cause disasters such as these; thus, the traditional focus in hazards community is risk-specific rather than cause specific. In contrast, climate action plans are cause-specific in their focus on climate-change causes and effects. Adaptation measures can, thus, be forgotten parts of mitigation-focused climate action plans (Laukkonen et al., 2009), even though many experts now agree that adaptation is a necessary component to climate change policy broadly (Bulkeley, 2013).

The earliest efforts to create CAPs were a function of environmental groups almost exclusively and were promoted via international organizations primarily designed to mitigate greenhouse gasses. Mazmanian et al. (2013) argue that adaptation measures have traditionally been added as an afterthought—or a side benefit—to development projects as opposed to primary drivers of climate policy by themselves. As adaptation has become a political reality, the IPCC and other international climate organizations have begun to seriously explore and advocate for adaptation as a critical component of CAPs. Thus, the age of the plan ought to be negatively associated with extent of adaptation, leading to our final plan-specific hypothesis:

H1c: Older CAPs are likely to be less extensive in adaptation measures than newer plans.

Other Determinants and Barriers to Adaptation in Climate Action Plans

The paragraphs that follow outline additional major determinants of climate action policies at the city level, with special attention to adaptation. The current literature on adaptation in cities is largely inductive (for a review, see Martins & Ferreira, 2011). Given the relatively small proportion of cities considering adaptation as a formal part of climate policy and the relatively ad hoc or experimental nature of these efforts (Castán Broto & Bulkeley, 2013), much of the literature attempting to account for adaptation strategy focuses on the barriers to adaptation as much as the determinants (Archie, 2013; Measham et al., 2011; Picketts, Déry, & Curry, 2013).

Political Demands

The political environment of adaptation policy is similar to mitigation insofar as city leaders have to be persuaded into (i) agreeing that climate change is occurring, (ii) that its effects will be felt at the local level, and (iii) that a city ought to do something about it. The arguments for adaptation do not hinge upon the source of climate change (human-induced versus natural), which places the discussion of adaptation in a different domain of political advocacy than climate action planning focusing on mitigation. Adaptation efforts, unlike the reduction of city-generated GHGs, have inherently local impacts on citizens. However, adaptation planning still requires a faith in climate modeling to determine impacts of a warming climate. Thus, the politics of climate action planning are similar to other environmental policy insofar as cities with greater numbers of Democrats are more likely to address climate issues—related to adaptation or mitigation.

H2a: CAPs in cities with more Democratic voters will have more extensive adaptation measures.

Environmental groups are likely to agree that cities ought to have climate action plans, but the content of these plans may not be of universal importance (Brody et al., 2010). Previous studies have indicated that climate action plans are stronger in *mitigation* when local environmental interests are stronger (Krause, 2011b; Lee, 2013), but this stands to reason given the universal desire to reduce GHGs as a part of other broader environmental goals. In theory, one would expect environmental groups to value strong CAPs *in general*, which would include a stronger adaptation component, but this is an as yet untested hypothesis.

H2b: Cities with more extensive environmental group activity will produce CAPs with more extensive adaptation measures.

Transmunicipal Networks

The literature on climate planning—and local environmental policy in general—finds that transmunicipal climate action networks (e.g., ICLEI) are important in advocating for change, but also in providing solutions to environmental problems (Krause, 2011b; Sharp et al., 2011). Transmunicipal networks fill a gap in city-level capacity to conceive of solutions to climate change. However, the influence of networks that promote climate action plans has yet to be tested in considering adaptation efforts.

H3: Cities part of transmunicipal climate networks will have more extensive adaptation measures in CAPs.

Institutional Structure

The literature on urban politics suggests that preferences are important for understanding policy, but equally important is the institutional structure of a city in responding to those demands. More specifically, scholars have consistently found that strong mayors are more likely than weak mayors to sign climate protection agreements (Clingermayer, 1990; Lee & Koski, 2012; Lieberman, 2002). Strong

mayors have incentives to respond to political demands with public displays of support, a particularly important fact in the context of reluctant supra-governments (the federal government and state governments). We expect the same positive relationship between strong mayors and adaptation components given general desires to respond to climate change.

H4: Cities with strong mayors will have more extensive adaptation measures in CAPs.

Municipal Financial Capacity

American cities are faced with dilemmas regarding the allocation of resources to address climate change. Climate mitigation efforts are individually borne costs by cities for a collective benefit; whereas adaptation efforts are individually borne costs for individual cities. However, the "co-benefits" for many climate mitigation solutions (Engel, 2006; Kousky & Schneider, 2003; Sharp et al., 2011)—e.g., reduced energy costs—are immediate. The benefits associated with adaptation accrue in the future in the form of reduced losses as a result of decreased water supply or increased propensity for extreme weather events, but come with a significant upfront price tag. Moreover, studies have shown that the commitment of resources to adaptation mandates vastly underestimate the cost of appropriate measures to systemically ready a government for a warmer future (Craft, Howlett, Crawford, & McNutt, 2013). Despite this disconnect, contemporary adaptation measures remain expensive and therefore reliant upon the capacity of the city to make financial investments.

H5: Cities with greater financial capacity will have more extensive adaptation measures in climate action plans.

Proximity to Harm

The literature on climate action consistently finds proximity to harm to be the most reliable predictor of city-level mitigation and adaptation policies (Füssel, 2007; Henstra, 2012). In their meta-analysis of a series of single case studies, Hunt and Watkiss (2011) find that most cities with adaptation strategies of any kind are either near a coast or the Arctic. Presumably these are locations that face the most predictable and steady of landscape changes from climate change: sea level rise and far warmer temperatures (polar climates are warming much faster than equatorial). Cities near climate disaster prone areas or most at risk to subtle changes in climate are likely to engage in adaptation planning.

H6: Cities with more direct impacts anticipated from climate change will be more likely to adopt CAPs with more extensive adaptation measures.

Data Collection and Measures

The data for this study were assembled in three stages: collection, filtering, and coding. Collection began by searching for cities with CAPs on pre-collected

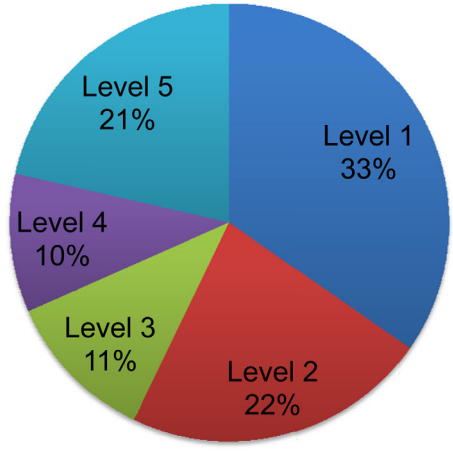

Figure 1. Distribution of Adaptation Extent in CAPs
Note: One measures no adaptation planning; six measures a plan in which adaptation planning is integrated throughout the CAP. N = 98 cities with populations greater than 50,000.

databases from the EPA, ICLEI, and the U.S. Conference of Mayors. In cases where a city did not appear on these national websites, we searched for the climate action plan of each city in the United States with a population over 50,000 (this was done typically by searching the city's government website). This search produced roughly 350 "plans." However, these "plans" included state-level, regional, city-level documents from Climate Action Plans to Sustainability Plans. Over two-thirds of these were drafts, municipal-only plans, without planning elements, or did not acknowledge climate change as the central purpose of the document. We culled these incomplete or inappropriate documents to obtain a final yield of 98 usable CAPs. In addition to the specific phrase "Climate Action Plan," CAPs in our dataset are titled Climate Protection Plans, Green Action Plans, etc., but all were finished, city-level documents that laid out a specific, goal-oriented plan to combat *climate change*.

Coding for Extent of Adaptation Planning

We developed a coding scheme to describe how each CAP characterized, integrated, and planned for the effects of climate change. The primary level of coding evaluated the plan's treatment of adaptation, numbering it one through five (see Figure 1).[3] Cities that do not plan for adaptation at all receive a code of one, even though the CAP might be comprehensive in other climate related policies (i.e., mitigation). For example, Trenton, New Jersey's 2010 Climate Action Plan was coded as a one. Even though it had a rigorous set of greenhouse gas inventories, reduction targets, and action items, it never mentions adaptation or adaptation planning. On the other hand, cities like Santa Cruz, California; Flagstaff, Arizona; and New York City had documents that planned exclusively for the effects of climate change (coded 5).[4] A flow diagram describing the coding process can be found in the Appendix Figure A1.

Levels two through four address plans that include some level of adaptation without being an adaptation-centered plan. The second level records CAPs that

mention adaptation, but at a very low level. For example, Minneapolis' 2013 Climate Action Plan focuses on reducing the city's "climate impact." The plan names adaptation in the introduction as "the ultimate goal" without further mention of it. Like other plans coded as a two, the Minneapolis CAP does not contain an integration of the concept of adaptation within its overall goals of climate policy.

Plans coded at level three take adaptation further, but usually only in framing or rhetoric. For example, Hayward, California's 2009 Climate Action Plan included a greenhouse gas inventory, greenhouse gas reduction targets, and reduction strategies. No adaptation-oriented goals were included due to a pending regional sea-level study, but placeholders for adaptation planning were placed consistently throughout the plan. Likewise, Chula Vista's 2000 CO_2 Reduction Plan addresses adaptation extensively, but incompletely and without planning components.

Level four CAPs incorporate adaptation significantly more than level three plans but lack a substantial planning component found in level five plans. For example, Santa Rosa's 2012 Climate Action Plan contains the scientific and policy context of climate change, and includes an inventory, reduction strategies, adaptation strategies, and a section on implementation. While adaptation was conceptually and structurally integrated into the plan beyond a level three plan, the adaptation planning strategies are not thorough. Like other level fours, it "plans to plan" for adaptation, instead of outlining policies to combat the direct effects of climate change.

Plans coded as level five are the highest level of adaptation planning without focusing only on adaptation. These plans commit significantly to adaptation conceptually, structurally, and in planning. Berkeley's 2009 Climate Action Plan is one of the nation's best plans in addressing adaptation. A section is devoted to adapting to climate change, outlining the local hazards of climate change and presenting a plethora of concrete ways to tackle the problem. From street-level tree master planning to water-saving urinals, Berkeley is coded as a level five due to its thoroughness and specificity.

Identifying Key Elements of CAPs

In addition to extent of adaptation measures in climate action plans, we also looked for different characterizations of consequences from climate change in motivating climate solutions. Specifically, the literature on climate change points to a number of potential impacts that will result from increased warming temperatures and the resulting climatological feedback, including: an increase in *vector-borne disease*, increased *severe weather events*, increased probably of *wildfires*, change in *animal* species behavior, change in local *vegetation*, potential for *floods*, a *rising sea*, decreased *air quality*, decreased *water quantity*, decreased *water quality*, and *droughts*. While not totally inclusive, we believe this list covers the major hazards and harms generally associated with climate change. To gain a sense of how the climate action plan conceives of the problem of climate change (by itself, climate change is not a problem, but the changes it brings to different social and ecological systems is tremendous) we code for the presence of these harms in a CAP's description climate change impacts (see Figure 2 for a frequency distribution).[5]

We then group these categories into environmental *harms* and environmental *hazards* that result from climate change. Changes to water quality, air quality, vegetation, and animal behavior could all be categorized as environmental *harms*—more akin to traditional issues governed by environmental policy. The remaining issues

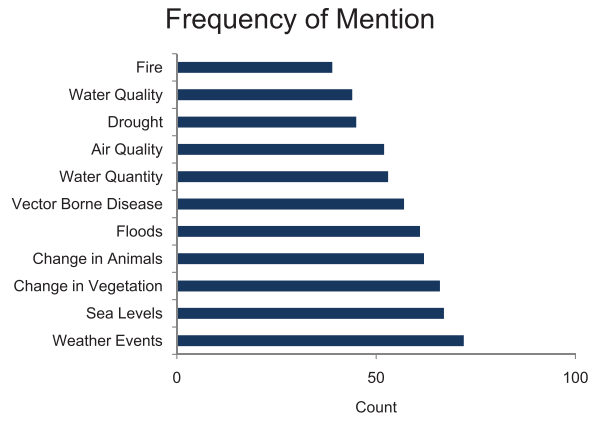

Figure 2. Frequency of Category Presence in Description of Climate Change Impacts

associated with climate change—increased likelihoods of vector-borne disease, wildfires, floods, sea level rise, water quantity, and drought are more typically associated with *hazard* management. For each of these two broad categories, we use a simple code for the presence of this association with climate change, sum the counts (all sums are greater than 0), and then average the sum over the number of possible types of each harm (four) or hazard (six). The mean for environmental *harm* is .57 and the mean response for *hazard* is .59.[6]

Investigating the Sources of Variation in CAP Adaptation

We conceptualize the extent of adaptation measures in CAPs as a function of the integration of adaptation goals in the overall plan. The dependent variable is scaled from 1 to 5. We regress the *adaptation extent* in CAPs against five broad categories of independent variables motivated by the literature on climate action planning. Our primary interest is in understanding the relationship between two communities of interest and adaptation planning, represented in the category of "plan-specific features." We create two indexes to comprise environmental harms and hazards associated with problems that motivate climate action planning. "Environmental harms" consist of a four-item scale comprised of concerns related to air quality, water quality, change in vegetation, and a change in animal habitat. "Hazards" associated with climate change consist of a seven-item scale comprised of concerns related to water quantity, increases in vector-borne disease, wildfires, sea level rise, floods, severe storms, and drought.

We employ two measures to capture the influence of politics on the extent of adaptation in CAPs (H2). To gain a sense of general partisanship, we use the percentage of the 2008 vote that Obama received in the city gathered by the U.S. Census. Second, as a rough measure of environmental group strength, we use the revenue generated by environmental nongovernment organizations (from the National Center for Charitable Statistics, log-transformed for skewed data). Again, our expectation is somewhat mixed in this context—on the one hand, more Democratic cities are likely to care about climate change, but this might manifest itself in mitigation at the expense of adaptation. We also examine the impact that signatory status in the Mayors' Climate Protection Agreement or in the Cities for Climate

Table 1. Descriptive Statistics

Variable name	Mean (s.d.)	Source
Dependent variable		
Adaptation embeddedness	1.91 (0.76)	Author coding
Plan characteristics (H1)		
Hazard focus	0.57 (0.34)	Author coding
Environmental harms focus	0.59 (0.38)	Author coding
Plan age (in years)	3.63 (2.70)	From plan
Political demands		
Partisanship (2008 Obama Vote)	59.50 (11.64)	U.S. Election Atlas (2008)
Environmental NGO revenues from city (ln)	17.90 (1.19)	U.S. Center for Charitable Statistics (2005); county-level data
Transmunicipal networks		
Cities for climate protection signatory	0.48 (0.50)	ICLEI CCP Program
U.S. Conference of Mayors signatory	0.81 (0.40)	U.S. Conference of Mayors
Strong mayor	0.29 (0.46)	Yearbooks of City County/Management Association
City general revenue (ln)	12.45 (1.36)	U.S. Census Bureau (2005)
Problem proximity		
Coastal city	0.39 (0.48)	Author Coding
Number of heating days (100s)	36.56 (19.64)	U.S. Census Bureau; Data collected from 1970 to 2000
Number of cooling days (100s)	10.81 (9.39)	U.S. Census Bureau; Data collected from 1970 to 2000
Other demographic variables		
Population (ln)	12.07 (1.04)	U.S. Census Bureau (2005)
Density (ln)		U.S. Census Bureau (2005)
Income ($1000s)	44.97 (14.06)	U.S. Census Bureau (2005)
Percent with college degree	0.33 (0.14)	U.S. Census Bureau (2005)

Protection (part of ICLEI) has on adaptation measures to assess the impact of transmunicipal networks on CAP content (H3). In theory these cities are likely to view climate action plans in the guide of GHG mitigation rather than adaptation; thus, contrary to conventional wisdom, we expect a negative relationship here.

We additionally test for the influence of government structure (H4) and government capacity (H5) via two distinct measures. We use a simple dummy variable for government type, where 1 = a strong mayor system and a 0 = all other forms of government. We use the general revenue for a city gathered by the U.S. Census to act as a proxy for city financial capacity (log transformed because of skewed data).

We characterize potential demand factors for climate change adaptation in terms exposure to general indicators of climate harms: the number of heating days, number of cooling days, and whether the city is coastal (Füssel, 2007; Hunt & Watkiss, 2011). Each of these harm variables ought to increase the desire for a city to demand adaptation measures in a climate action plan. For example, cities with a large number of cooling days will find warmer temperatures expand issues related to heat-induced injury. Finally, in the full model, we employ population, population density, per capita income, and education as demographic variables (these data are all from the U.S. Census). Descriptive statistics for all variables are found in Table 1.

Results

Three general findings emerge from the ordinal regression presented in three models (Table 2). The first model contains only plan elements, the second no plan elements with all other variables in the investigation, and the third a full model. In

Table 2. Ordinal Regression of CAP Adaptation Extent (DV coded 1–5)

Variable Name	Adaptation Extent (Plan Only)[a]	Adaptation Extent (No Plan)	Adaptation Extent (Full Model)	Marginal Effect on Level 5 Plan (Full Model)[d]
Plan Characteristics (H1)				
Hazard focus	1.27***[b]		1.06*	24%
	(0.47)		(0.63)	
Environmental harms focus	0.90**		0.88	–
	(0.42)		(0.54)	
Plan age (in years)	−0.16***		−0.22***	−40%
	(0.04)		(0.05)	
Political Demands				
Partisanship (2008 Obama Vote)		0.02	0.004	–
		(0.13)	(0.01)	
NGO Strength		0.07	0.06	–
		(0.62)	(0.15)	
Transmunicipal Networks				
Cities for Climate Protection signatory		0.08	0.30	–
		(0.31)	(0.34)	
U.S. Conference of Mayors signatory		−0.51	−0.46	–
		(0.38)	(0.43)	
Strong Mayor		−0.34	−0.69*	−14%
		(0.35)	(0.38)	
City General Revenue (ln)		0.06	0.13	–
		(0.31)	(0.33)	
Problem Proximity				
Coastal city		0.28	0.33	–
		(0.33)	(0.35)	
Number of heating days (100s)		0.006	0.002	–
		(0.01)	(0.01)	
Number of cooling days (100s)		−0.03	−0.02	–
		(0.02)	(0.02)	
Demographic Variables				
Population (ln)		0.09	0.13	–
		(0.37)	(0.40)	
Density (ln)		−0.25	−0.11	–
		(0.23)	(0.25)	
Income ($1000s)		−0.03**	−0.024*	−22%
Percent with college degree		1.53	2.34	–
		(1.20)	(1.30)	
N	98	92c	92	
Chi-square	43.21***	15.23	53.52***	
Pseudo R^2	0.15	0.06	0.19	

Notes: Standard errors in parentheses.

[a]Dependent variable is ordinal; 1 = weak adaptation extent, 5 = strong adaptation extent

[b]*p<.10, **p<.05, ***p<.01

[c]Six cities do are deleted listwise because of missing census data

[d]Marginal effects derived from percentage point difference between predicted values of achieving a five from varying an independent variable from the 5th percentile to 95th percentile of data range, holding all other variables at their means.

addition, Table 2 shows the marginal impact of moving from the 5th to the 95th percentile of significant independent variables while other variables are held at their mean in predicting a value of five in the dependent variable (representing CAPs with the most extensive adaptation planning).

Three general findings emerge from the regression results. First, climate change expressed as an environmental hazard leads to a greater inclusion of adaptation in a climate action plan. Different problem definitions speak to different communities of interest, which lead to stronger and weaker adaptation efforts. Second, most demand and demographic variables are not found to be statistically significant influences on

plan outcomes, which is curious given previous work on the subject. Third, signatories to climate protection agreements are no guarantee for adaptation; however, strong mayors are less likely to pursue adaptation as a part of a climate action plan.

How climate change is characterized in CAPs emerges as a strong, important determinant of the extent to which cities incorporate adaptation in their strategy to address climate change. In theory, any negative outcome associated with climate change ought to provide an impetus for climate action—mitigation or adaptation. In practice, however, the language used to describe climate outcomes matters. The results show that cities that think of climate change in the language of hazards (H1a) adopt more extensive adaptation measures than cities that do not (marginal effect is 24 percentage points for a strong hazards focus). Importantly, we find no effect in the ordered regression results for variation in the language of environmental harms (H1b).

In addition, most demand variables associated with greater regulatory policy action—specifically environmental policy—are not found to be influential in producing CAPs with stronger integration of adaption components. The results find no support for hypotheses H2a (partisanship and adaptation), H2b (environmental group strength and adaptation), and H5 (municipal financial capacity). Logically these are factors associated with stronger climate action planning; however, the literature on local climate policy has revealed a number of nonfindings for these types of variables (Bae & Feiock, 2013; Krause, 2012b; Lee & Koski, 2012) indicating that climate action planning is subject to a broader coalition of actors than typical environmental policy. In this case, the nonfindings suggest the political calculus associated with adaptation planning, follows a less politically ideological logic. These traditional environmental indicators are not indicative of adaptation planning, which is a further indication that adaptation planning is not thought of as the same type of "environmental" issue. Of the other demographic variables we test, only income (negative) influences the inclusion of adaptation measures. As with political variables, research on local climate policy has produced inconsistent results for demographic variables such as population and income (Krause, 2011c, 2012b).

Finally, the results in Table 2 suggest a significant difference between the literature on climate action planning in general and the literature on adaptation planning. While the literature consistently has shown transmunicipal climate networks to influence city-level mitigation actions, our findings highlight the lack of adaptation as a focus in their suggestions for climate action. However, these organizations have recently begun to shift toward adaptation, with ICLEI producing an adaptation "tool" similar to its widely used mitigation "tool" for climate action planning. This change in thinking about adaptation planning is reflected in the strong negative finding associated with plan age and adaptation efforts—newer plans are far more likely to have stronger adaptation components than older plans.

Interestingly, cities with strong mayors are less likely to have CAPs with a strong emphasis on adaptation, but this finding is comparatively weak in terms of marginal effect (−14% for cities with strong mayors producing strong plans). This finding goes against the hypothesis we derive from the literature but, given the nonfindings regarding transmunicipal networks and the strong hazards finding with regard to adaptation, it would stand to reason as part of a broader political logic on the parts of mayors. Strong mayors are rent seekers and are more likely to play to the audience of an environmental community—CAPs are often urban renewal

packaged in an environmental plan. Much of this urban renewal deals with new developments that include energy efficiency and other transportation overhauls for which mayors are rewarded politically because of the immediacy of the benefits to be distributed to citizens. Adaptation measures are long-term investments that are more likely to be found in cities where managers with longer government timelines have more sway.

Conclusions: Planning for Climate Change

Our unique dataset contributes to the growing study of subnational efforts to address climate change that has hitherto concentrated on climate mitigation efforts. In contrast to most other adaptation studies that examine one or a handful of cities, our study is the most comprehensive examination of adaptation efforts in the United States. Our study supports three major conclusions that hope to inform the future academic study and policy making related to climate action in the United States: (i) U.S. cities have yet to integrate adaptation into existing climate action strategy; (ii) framing climate change in the language of hazards creates a different set of problems, questions, and solutions than the traditional school of thought that framed climate change as an environmental issue; and (iii) because adaptation has been framed apart from traditional environmental issues, U.S. cities hitherto reluctant to engage in climate change policy may find adaptation planning an appropriate and less politically charged entry point into the discussion.

First, we find that adaptation is generally absent from most cities' efforts to address climate change insofar as CAPs are representative of city-level climate policy. Climate action plans provide an important unit of analysis because they represent how cities characterize climate harms, the tools cities intend to use to address these harms, and revealed preferences regarding how a city will develop its carbon regime for the future (Gibbs & Jonas, 2000; Jonas, Gibbs, & While, 2011; Keil, 2003; While, Jonas, & Gibbs, 2010). A comprehensive climate action plan would consider adaptation as well as mitigation. However, our research shows that adaptation efforts are effectively absent from nearly half of all climate action plans we found, with one-third of the plans failing to mention adaptation at all.

Second, how communities talk about climate change influences the extent to which they are going to adapt to it. The communities of interest advocating for climate conceive of climate action in terms of environmental harms are less likely to plan for adaptation than communities of interest that think of climate change as a natural hazard. The costs associated with adaptation efforts are often great and the potential payoff associated with those efforts can be relatively distant and uncertain. The broader community of actors involved in planning for the types of actions related to adaptation—e.g., sea walls, infrastructure improvement, transportation planning—are more likely to be associated with public works and hazards planning than environmental regulation. While not required as is the case in hazards planning, adaptation planning has more in common with planning for earthquakes, hurricanes, or snowstorms than for environmental harms. Emergency managers and hazards planners are typically not concerned with stopping the source of these calamities because they often have no control. However, they can plan for the

events using the tools of disaster management. In contrast, other environmental harms (e.g., air pollution) can be directly attributed to particular causes and are more amenable to solutions that directly address these causes. While it is possible to adapt to air pollution (indeed, we have), the primary focus of most environmental policy is to stop or reduce the harm from occurring in the first place.

Two basic, non-mutually exclusive dimensions of climate action are displayed in CAPs: climate action as prevention and climate action as response. Public risk planning of climate action as response enjoys less political salience and follows a more traditional model of "boardroom politics" than the mitigation planning of prevention—even in the relatively politically prosaic field of urban planning. This is not to suggest that cities are not interested in both, but merely that cities that think of climate change as leading to hazards are more likely to think about ways to prevent those hazards.

To be fair, it is likely that cities are conceiving of climate harms that fit the solutions offered in CAPs. In other words: this relationship might be endogenous. But the overall picture for the data is interesting for what we find and what we do not find. Whereas it is true that hazards framing leads to adaptation solutions, environmental harms framing does not—even though both kinds of framing are specific to characterizing the problem of climate change. In addition, the traditional drivers of stronger environmental policy—interest groups and democratic populations—are not found to be influential in creating climate action plans with strong adaptation components. Transmunicipal networks—nearly universally found to create stronger mitigation components in climate action plans—are not found to influence the incorporation of adaptation into CAPs. The findings regarding the signatory status of cities is methodologically important because we often use signatory status to the USCMCPA or the CCP as proxies for commitment to climate change policy. Our research shows that these common transmunicipal climate change networks tell us little about a commitment to adaptation—at least as of right now. ICLEI has recently created a "milestones" program for adaptation similar to their long-standing mitigation "milestones" program, which may change this relationship in the future.

Third, the idea of adaptation, which may be perceived as dealing with symptoms rather than real problems, is a potentially powerful message in motivating action on the parts of cities that do not fit the typical "climate policy" profile. Wood, Hultquist, and Romsdahl (2014) have shown that many cities that do not have overt climate action programs, plans, or policies still engage in behaviors that can be seen as climate action. However, because of ideological hurdles across the United States, but particularly outside large urban areas, linking municipal plans or policies to climate change is politically toxic. "Mitigation-first" strategies, which depend upon a particular environmental ethos (humans are causing climate change, we can do something about it, and we should do something about it) are less palatable than an "adaptation-first" strategy. Adaptation-first acknowledges a changing climate, but in such a way that localizes the capacity to counter the harms associated with this changing climate.

As climactic conditions worsen, the line between thinking of climate change as hazards issue or an environmental issue will likely blur. The 4-year California drought provides a powerful example. All California cities have been forced to think about climate change as a current, rather than distant, issue to be understood

as both hazardous to human health as well as harmful to the environment. Our results show that the typical demographics associated with environmental or climate policy in U.S. cities (large, liberal, rich) tell us nothing about whether cities decide to adapt. There is a real openness, then, for communities to acquaint themselves with climate change by attempting to first conceive of impacts in the more widely accepted language of hazards. While this may enforce some path dependence in terms of solutions, increasing climate planning in any form across the United States is a worthy goal.

Regardless of any actions, climate change will continue to occur (Stocker et al., 2013). If the world were to completely stop CO_2 and other GHG emissions, the current stock of atmospheric CO_2 is sufficient to guarantee future warming (Archer, 2012). Most climate change models predict that the earth's temperature will collectively raise between 2 and 3.5 degrees; even with the IPCC's most aggressive and optimistic scenario, the earth we know today will be a different place in as little as 25 years (Stocker et al., 2013). Longer term modeling, while necessarily higher in uncertainty, has very little hope of a return to the previous climate for existing infrastructure, spatial distribution of settlement, and distribution of resources (Vaughan, Lenton, & Shepherd, 2009). Even if these data are not known or believed by localities, communities are feeling the effects of unprecedented droughts, increased storm surges, warmer winters, and hotter summers. Where communities may not act in the name of climate change, our examination of climate action plans indicates speaking in the language of hazards can bring climate action to local communities that otherwise might not engage. We hope our research has broader implications about how communities of all types can proceed in addressing climate change.

Limitations and Opportunities for Future Study

Our study is a first cut at quantitative analysis of adaptation in cities, which means that there are many limitations to our findings. We have sacrificed specificity in plan coding for quantity of plans. Future research in climate adaptation plan analysis might examine plans for the presence of some agreed upon set of adaptation plan elements. Additionally, our analysis says nothing about the validity of CAP adaptation components. A feature of CAPs is that many measures—adaptation or mitigation—run the gamut of concrete to fantastical. Third, our study has a limited understanding of the city-specific hazards that face each location because of data and modeling limitations. Indeed, the extant literature on climate change is comprised of a number of in-depth case studies that do precisely this. Future research may be able to use geographical information system analysis to better match plan characteristics with location-specific harms.

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Methodological Appendix

We include a visual flow chart for our coding of the presence of adaptation in climate action planning.

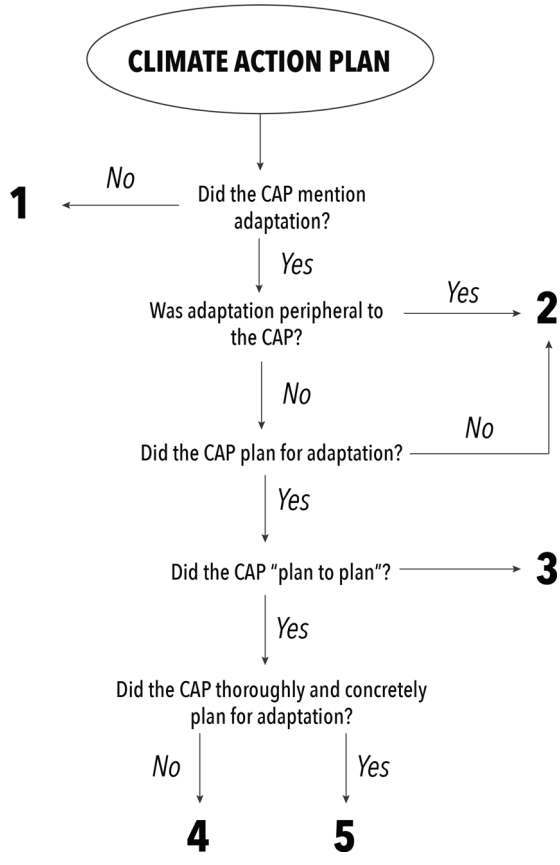

Figure A1. Flow Diagram of CAP Coding for Study

Notes

1 The authors thank the comments of an anonymous reviewer for this observation.
2 ICLEI has recently added a focus on adaptation which partially may help to explain the renewed focus on adaptation to climate change in new CAPs.
3 For a sample of 10 CAPs (roughly 10% of the data), the level of agreement across coders was 90% and 100% after consultation.
4 Plans are not coded based upon the enforceability of provisions or the extent to which provisions mandate change on the parts of the city, citizens, or firms.
5 All cities mention multiple types of harms associated with climate change. Thus, the sum of the counts for each category exceed the total number of CAPs.
6 It is possible, indeed, likely that cities' characterizations of climate impacts will be some combination of harms that face the city itself, but also harms that are generic to climate change. For example, 64% of cities in our dataset describe sea level rise as a problem related to climate change, but only 39% of the cities in the dataset are situated on a coast.

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