Coping with Climate Change:

Toward a Theory of Adaptive Capacity

by

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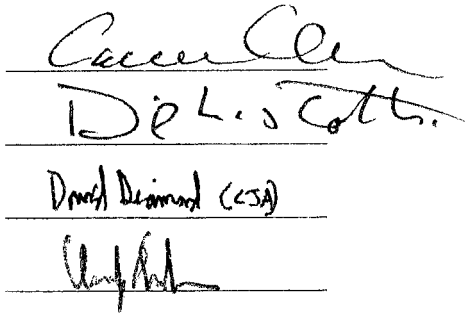

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ABSTRACT OF THE DISSERTATION

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As the earth's climate changes in response to atmospheric greenhouse gases, communities around the world will be faced with new conditions. This dissertation investigates factors that influence the ability of municipalities to adapt to a changing climate.

Prior literature has assumed that there is a relationship between adaptive capacity and indicators of socio-economic status (SES) such as income and race. However, this relationship has not been adequately tested at the community level.

This dissertation makes three contributions to literature on adaptive capacity. First, it offers a quantitative test of the relationship between SES and adaptive capacity at the community level. The evidence presented in this dissertation supports the previously hypothesized relationship.

Second, I employ social capital theory, regime analysis and structuration theory to explain the relationship between SES and adaptive capacity. I argue that racial and economic polarization can discourage the formation of a stable and broad-based governing coalition, thereby diminishing the development of adaptive capacity.

Third, the dissertation presents a historical comparison between Louisville, Kentucky and New Orleans, Louisiana to illustrate the usefulness of social capital theory, regime analysis and structuration theory to the study of adaptive capacity.

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List of Abbreviations

ACS	American Community Survey
BCEGS	Building Code Effectiveness Grading Schedule
CBO	Community Based Organization
CDBG	Community Development Block Grant
CIC	Commission on Inter-racial Cooperation
CRS	Community Rating System
CVI	Coastal Vulnerability Index
DHS	Department of Homeland Security (U.S.)
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GAO	General Accounting Office
GHG	Greenhouse Gas
HUD	Department of Housing and Urban Development (U.S.)
IPCC	Intergovernmental Panel on Climate Change
ISO	Insurance Services Organization
LADA	Louisville Area Development Association
LOJIC	Louisville/Jefferson Information Consortium
MSD	Metropolitan Sewer District (Louisville)
NAACP	National Association for the Advancement of Colored People
NFIP	National Flood Insurance Program
NJAC	New Jersey Administrative Code
NJDOT	New Jersey Department of Transportation
NWS	National Weather Service
OLS	Ordinary Least Squares
PCA	Principal Components Analysis
SES	Socio-Economic Status
SFHA	Special Flood Hazard Area
SLR	Sea Level Rise
SoVI	Social Vulnerability Index
TAR	Third Assessment Report
UCC	Uniform Construction Code
WYO	Write Your Own

Chapter 1: Introduction

As the earth's climate changes in response to atmospheric greenhouse gases, communities around the world will be faced with new conditions. This dissertation investigates factors that influence the ability of municipalities to adapt to a changing climate.

Prior literature has assumed that there is a relationship between adaptive capacity and indicators of socio-economic status (SES) such as income and race. However, this relationship has not been adequately tested at the community level.

This dissertation makes three contributions to literature on adaptive capacity. First, it offers a quantitative test of the relationship between SES and adaptive capacity at the community level The evidence presented in this dissertation supports the previously hypothesized relationship.

Second, this dissertation draws upon social capital theory, regime analysis and structuration theory to explain the relationship between SES and adaptive capacity, arguing that racial and economic polarization can discourage the formation of a stable and broad-based governing coalition, thereby diminishing the development of adaptive capacity.

Third, I present a historical comparison between Louisville, Kentucky and New Orleans to illustrate the usefulness of social capital theory, regime analysis and structuration theory to the study of adaptive capacity.

The purpose of this short chapter is to introduce the concepts that I will explore in the rest of the dissertation, and to provide a roadmap for my course of inquiry.

Chapter 2 offers a description of prior research, both quantitative and qualitative, on the topic of adaptive capacity. Three gaps in the earlier literature are noted.

First is the problem of scale. This refers to the fact that most studies of adaptive capacity, particularly quantitative studies, are performed at the national level. Thus, studies look for factors associated with the adaptive capacity of nations. I argue that there is room in the literature for research that addresses scales other than the national level, such as state or local levels.

The second problem is the lack of specificity. Most quantitative studies use very general proxies for adaptive capacity, such as deaths related to natural disasters. While this approach has its uses, I maintain that there is also a need for studies that analyze the adoption of specific adaptations in specific places.

The third problem revolves around the relationship between individual vulnerability and group vulnerability. Prior literature assumes that the adaptive capacity of a community will be influenced by the socio-economic status (SES) of individuals living in that community. For example, we might imagine two towns that differ in average levels of educational attainment among the adult population. Although some earlier literature has assumed that the more highly educated town is more likely to have a high level of adaptive capacity, I contend that this relationship is not obvious. There is no reason, a priori, to believe that the blue collar town cannot elect a good mayor, or establish a professional municipal workforce. Nor is there necessarily a reason to believe that the decisions made by officials in the blue collar town will be constrained by the educational levels of the town's residents. At the community level, the causal link between SES and adaptive capacity is not direct.

Thus, I argue in Chapter 2 that the assumed link between SES and adaptive capacity needs to be empirically tested at the community level. Further, the structuration theory of Anthony

Giddens (1984) offers some concepts that may be useful in explaining any connection between SES and the adaptive capacity of communities.

Chapter 3 argues that participation in a program known as the Community Rating System (CRS) is a good proxy for adaptive capacity. Thus, this chapter contains background information on the CRS program, and defends its use as a proxy.

CRS is part of the National Flood Insurance Program (NFIP). Municipal governments can choose whether to participate in CRS. Participation in the program requires a city to document that it meets certain standards for effective floodplain management. Residents of participating cities are eligible for a discount on flood insurance rates.

CRS is a point-based system. For every 500 points that a community accumulates, residents of the community may deduct 5% from flood insurance rates. A community may receive points for a diverse range of activities including effective evacuation planning, enforcement of rigorous building codes, preservation of open space, and other activities. The Insurance Services Organization (ISO) verifies each community's activities and assigns point values accordingly.

Ocean City, New Jersey is presented as an example of a participating city. In Ocean City, a critical success factor was the ability of city officials to maintain relationships. Four types of relationships are identified: relationships between departments within city government, relationships between city government and other levels of government, relationships between city government and the business community, and relationships between city government and non-profit organizations.

Chapter 4 provides a quantitative test of the hypothesized link between SES and CRS participation. The dependent variable, CRS participation, is measured in several ways. First,

I construct binary variables to indicate whether a city participates in the CRS program, and to indicate the level of participation. The level of CRS participation can also be used as a continuous variable.

The independent variables are all aggregated indicators of socio-economic status at the community level. Average levels of education and income are used, along with percentage of racial and ethnic minorities, poverty rates and home values. Because of multicollinearity, I use Principal Components Analysis to summarize the independent variables. The PCA extracts factors that can in turn be used in regression analyses.

Probit models are presented that treat CRS participation as a binary variable, with factors extracted in the PCA used as independent variables. Diagnostics are used to test the ability of the probit model to predict both successes and failures. Next, OLS and tobit models use level of CRS participation as the dependent variable, with the PCA factors as independent variable. All regression models control for flooding risk.

Two separate samples are used. First, I run probit, OLS and tobit models on a national sample that includes all of the more than 10,000 cities that have had flood insurance claims in the last 30 years. Second, I repeat the analysis using a smaller sample of 176 coastal New Jersey communities. The New Jersey sample includes some governance variables for which data were not available at the national level.

The evidence presented in Chapter 4 is strongly consistent with the hypothesis that aggregated indicators of SES are associated with CRS participation. This conclusion is supported regardless of how the dependent variable was constructed, and no matter what type of regression model is used. Both the New Jersey and the national samples supported the principal conclusion, and the governance variables included in the New Jersey analysis did

not alter the central finding. I conclude that the association between SES and CRS participation is very robust.

Chapter 5 draws on three bodies of social theory to explain the relationship between SES and adaptive capacity at the community level. The theories employed are regime analysis, social capital theory and structuration theory.

The central question in regime analysis is as follows: What conditions allow a city to develop the capacity to accomplish significant goals? Stone (2005) asserts that four conditions must be present. First, a governing coalition that includes both government and non-governmental actors must exist, and the coalition must be able to last over time. Second, the coalition must share some goals or agenda. Third, the coalition needs resources. Finally, there must be a set of informal rules to set forth the manner in which communication and coordination can occur. The main lesson that I draw from regime analysis is that to explain the nature of governance in a given place, it is necessary to look at governing coalition: who is in the coalition, what is the coalition trying to accomplish, and how do coalition members cooperate?

Social capital theory posits that the nature of governance in a place is strongly influenced by the nature of civic engagement. Putnam (1993 and 2000) observes that well-governed communities tend to have several things in common. These places are characterized by an active and engaged citizenry who participate in civic organizations and communicate respectfully with diverse types of people. Such places produce electorates that value government services, and reward politicians who can deliver services effectively and efficiently.

Szreter (2002) argues that this virtuous cycle breaks down in the face of racial or economic polarization. In Szreter's view, persons in highly polarized places are primarily concerned with using government to benefit their own social or economic group. Such a dynamic leads to an "us vs. them" dynamic in politics, which is more conducive to corruption and cronyism than to efficient and professional service delivery. The central hypothesis that I derive from social capital theory, then, is that high levels of polarization can reduce the effectiveness of governance in a place, and thereby diminish the level of adaptive capacity.

The third social theory cited in Chapter 5 is the structuration theory of Anthony Giddens (1984), as interpreted by Frolich, Corin and Potvin (2001). My primary interest in structuration theory is methodological. As viewed through the lens of structuration theory, the central question addressed in this dissertation can be reframed as follows: How is the agency of local leaders enabled or constrained by the social structure, including elements of social stratification? The methodological insight gleaned from structuration theory is that to answer this question, it is necessary to focus on practices--specific, concrete actions taken by individuals. By placing practices in the context of the social structure in which they are embedded, it is possible to outline the processes by which elements of social structure, such as race or education levels, can affect the practices of local leaders.

Drawing on these three theories, I advance the hypothesis that SES affects adaptive capacity in part through the effect that socio-economic aggregates have on polarization. As noted in Chapter 3, one practice that was crucial to adaptive capacity in Ocean City is the maintenance of relationships between actors in city government and external actors. This is consistent with regime analysis, which asserts that relationships among government and non-government actors are necessary for the formation of a regime. Social capital theory,

particularly as reworked by Szreter (2002) argues that the kinds of relationships are most likely to form in places not characterized by high levels of racial or economic polarization. Synthesizing these thoughts into a single thesis, I hypothesize that stable and broad-based governing coalitions are conducive to the development of adaptive capacity, and that these governing coalitions are less likely to emerge when a large number of individuals in a community are economically disadvantaged.

Chapter 6 illustrates how the concepts articulated in Chapter 5 might be applied. A comparison of Louisville, Kentucky and New Orleans, Louisiana presents evidence that is consistent with the hypothesis advanced in Chapter 5. Louisville, I argue, is a city with a high level of adaptive capacity. New Orleans is a city that has shown a low level of adaptive capacity. Historically, Louisville has been a racially inclusive city, particularly compared to other Southern cities before 1970. By contrast, New Orleans, until around 1970, was dominated by a caretaker regime devoted to the preservation of white privilege. In Chapter 6, I argue that the level of racial inclusion or exclusion between 1900 and the 1960s had important and long-lasting effects on governance in the two cities. Although this evidence is only suggestive, it is consistent with the theoretical constructs proposed in Chapter 5.

Chapter 7 offers some concluding thoughts regarding policy and theoretical implications, and possible directions for future research.

Chapter 2: Climate Change and Adaptive Capacity

2.1 Introduction

There is now a consensus in the scientific community that the earth is warming, and that current concentrations of greenhouse gases (GHGs) in the atmosphere make additional climate change inevitable (Intergovernmental Panel on Climate Change 2007). Over the next century, individuals, communities and nations will be forced to adapt to new conditions caused by climate change. Inland areas will be faced with changing temperatures and precipitation, which may affect health, agriculture, water management and other systems. Coastal areas will also face challenges related to sea level rise, including inundation, erosion, loss of wetlands, saltwater intrusion and increased flooding risk.

The need for communities to adapt to new conditions has led to the emergence of a scholarly literature devoted to the notion of "adaptive capacity." This literature review traces the development of this concept. First I describe the literature on adaptation that grew out of impact assessment studies in the 1990s. Second, I summarize the discussion of adaptive capacity that was stimulated by the third report of the Intergovernmental Panel on Climate Change (IPCC) in 2001.

Third, I note three overlooked areas in existing literature on climate change and adaptive capacity: (1) There is a need for additional studies at scales smaller than nation-level. (2) current literature lacks theoretical specificity regarding the relationship between individual vulnerability and group vulnerability. (3) There is a need for greater specificity. In addition to general discussions of adaptive capacity, there is a need to look at the capacity of places to adopt specific adaptations.

Fourth, I argue that the problems observed in literature on climate change and adaptive capacity also apply to a broader literature on hazards and vulnerability. Studies of climate change and adaptive capacity are part of a much larger literature. Since this review focuses on the concept of adaptive capacity, I will not attempt an exhaustive summary of the broader literature. It is worth noting, however, that the theoretical holes in current literature on adaptive capacity have not been entirely resolved in the broader hazards literature. To develop this argument, I will describe the unresolved tension between individual and group vulnerability as revealed in the recent work of Susan Cutter.

Finally, I argue that each of the problems raised in the preceding sections is related to the problem of agency: In a given place, who has the ability to choose among adaptation options, and how are decisions constrained or empowered by social structures? A rich understanding of adaptive capacity will take into account the agency of decision makers at multiple scales. The structure/agency dilemma takes the discussion into the realm of social theory. I attempt to show that integrating social theory into the study of vulnerability can be useful both for understanding and for enhancing adaptive capacity. In particular, the capabilities approach of Amartya Sen as interpreted by Nussbaum (2003) and the structuration theory of Anthony Giddens (1984) point the way toward a tentative solution to problems in existing literature.

2.2 Adaptation to Climate Change

Over the last century, the earth's surface has warmed by about one degree Celsius, and ocean temperatures have risen by nearly two degrees (Intergovernmental Panel on Climate Change Working Group I 2001). Much of the change has been attributed to greenhouse

gasses (GHGs) in the atmosphere, which trap energy from the sun within the atmosphere. Since the industrial revolution, the concentration of GHGs has risen from about 280 parts per million by volume (ppmv) to about 387 ppmv.[1]

Current models estimate that the earth's temperature will continue rising by two to six degrees by the end of the century, assuming that GHG concentrations are stabilized at 680 ppmv by the middle of the century. This may be an optimistic assumption: The Intergovernmental Panel on Climate Change (IPCC) is now asking modelers to analyze impacts of GHG concentrations as high as 1380 ppmv to reflect the failure of the industrialized world to curtail GHG emissions (Bice 2006).

Since it takes atmospheric CO_2 more than a century to dissipate, the earth would continue warming even if GHG emissions were stopped immediately. Given that GHG emissions continue to rise unabated, climate change is likely to continue well into the next century (U.S. Department of Energy 2006).

Natural scientists and economists have devoted considerable effort to analyzing impacts of climate change. Nordhaus and Boyer (2000) have identified fifteen types of impacts, including agricultural change, sea level rise, human health impacts and electricity usage.

The study of adaptation to climate change initially emerged from climate change impact estimates. In its second assessment, the IPCC reviewed five studies that offered impact assessments for the U.S. economy. The estimated impacts of climate change in these works ranged from 1% to 2% of gross domestic product (IPCC 1996).

These first generation estimates have been criticized for overlooking the possibility that successful adaptation could reduce impacts (Mendelson et al. 1996, Yohe et al. 1996). Later

[1] Carbon Dioxide, or CO_2, is the most abundant GHG in the atmosphere, and GHG concentrations are usually expressed in CO_2 equivalents.

studies corrected this oversight by incorporating the possibility that society would be able to adapt to new conditions, and thereby reduce aggregate costs. A literature review by Preston and Smith (2004) found that four studies published between 2000 and 2004 produced impact estimates that ranged from 0.1% to 0.25%. Thus, considering the possibility of adaptation reduced impact estimates by an order of magnitude.

The analysis of agricultural impacts illustrates the incorporation of adaptation potential into second generation studies. Schneider et al. (2000) review literature incorporating increasingly sophisticated models of farmer behavior. As described by Schneider, early assessments used the "dumb farmer" (206) scenario, implicitly assuming that farmers would not change their agricultural practices in response to changing temperature and precipitation. To correct this deficiency, later studies assumed that farmers would have perfect foresight. In these models, farmers practiced optimal adaptive measures, from water conservation in the short run to crop translocation in the long run. "Clairvoyant farmer" (206) models reduced impact estimates dramatically, but were probably as unrealistic as the "dumb farmer" model in earlier studies. A middle course, called the "smart farmer" (206) model by Schneider et al., assumes that farmers will react rationally to changing conditions, but that they will still be confronted with considerable uncertainty. In the face of uncertainty, adaptations will occur more slowly than under assumptions of clairvoyance.

As the literature developed in the 1990s, distinctions between different types of adaptation became delineated. Three distinctions that became important to later discussions of adaptive capacity were as follows:

Resiliency vs. Adaptation: In many ways, the concept of adaptive capacity, as used in climate change literature, resembles the notion of resilience, as used in literature on natural

hazards. Despite the similarities, no consensus has emerged regarding the relationship between these two terms, or the relationship of either concept with the notion of vulnerability.

Gallopin (2006) notes that the concepts of adaptive capacity and resilience both borrow from the natural sciences. Resilience is a term taken from physics. Key ideas related to resilience are that of a domain, or basin of attraction within which an object may fluctuate; an attractor, or equilibrium state to which an object will tend; and perturbation, or a disturbance to the system. Viewed within this framework, the resilience of an object or a system may be measured in terms of the strength of the perturbation to which a system can be subjected while still remaining within its original domain. These ideas have been adopted in the field of ecology, and have shaped studies of the interaction between human systems and natural hazards.

Gallopin defines adaptive capacity as the ability to become adapted to new environments, a notion that borrows vaguely from evolutionary biology. Gallopin notes that adaptive capacity should not be confused with "adaptness" (300), which he defines as the degree to which an organism is well adapted to the environment that it lives in. The ability to adapt to new conditions is a key focus of climate change researchers for obvious reasons.

Gallopin argues that although these concepts are clearly related, the precise nature of the relationship is anything but clear. According to Gallopin, both are somehow related to vulnerability, but scholars differ on whether adaptive capacity is part of resilience, or resilience is part of adaptive capacity. Other questions include the following:

> What is meant by "harm" or "transformation" (structural change, shifting domains of attraction, moving away from equilibrium states or trajectories? Is positive vulnerability a useful notion? Does vulnerability apply to internal perturbations? Is vulnerability a property of the system or of the relationship between the system and

> the perturbation? Is negative (perverse) resilience a suitable concept? Does adaptation include improvements of the system in a non-changing environment? Is adaptive capacity the same as capacity of response? (302)

Gallopin concludes that making sense of the concepts of vulnerability, resilience and adaptive capacity "can become epistemologically very messy" (301).

Klein, Nicholls and Thomalla (2003) offer a critique of the idea of resilience. One criticism is that to the extent that resilience means returning to an original state, then it is not clear that this is even desirable: "If a megacity is struck by a disaster, it follows that the original state was one in which it was vulnerable to the disaster in the first place. Going back to this original state is undesirable, as it would leave the city just as vulnerable to the next disaster" (42). Klein et al. allow that some research on resilience has tried to modify the concept to include adaptation and adaptive capacity, but argue that this has not altogether redeemed the basic notion of resilience. They consider two major questions that a study of resilience might be expected to address: Does enhanced resilience reduce the vulnerability of megacities to natural hazards; and is resilience a useful concept for hazard risk reduction in megacities? In thinking through these issues, the authors conclude that "the problem with resilience is the multitude of different definitions and turning any of them into operational tools. The answers to the previous two questions depended on the assumed definitions of resilience, none of which are operational. After thirty years of academic analysis and debate, the definition of resilience has become so broad as to render it almost meaningless" (42).

Klein et al. suggest restricting the definition of resilience to include two categories of analysis: "the amount of disturbance a system can absorb and still remain within the same state or domain of attraction; and the degree to which the system is capable of self organization" (43). They then suggest that adaptive capacity be considered an umbrella

concept to address the ability of human systems to plan for and prepare for disasters, with resilience considered to be one property that can affect adaptive capacity.

Thus, Klein et al. offer one definition of the relationship between adaptive capacity and resilience. Other formulations are possible. One alternative definition might be gleaned by borrowing a set of concepts from engineering. Andrews (1995) distinguishes between robustness and flexibility in the electrical power industry. Flexibility means that a system is designed "so that changes can be easily and inexpensively made" (420). Robustness means that a system is designed to "perform well across a variety of futures" (420). There are clear links between flexibility and adaptive capacity on the one hand, and between robustness and resilience on the other. The relationship between flexibility and robustness may be useful in integrating the insights of the literatures dealing with resilience and adaptive capacity. Addition research and discussion of this point would be useful to both bodies of research.

As noted by Gallopin, there is certainly a connection between the concepts of vulnerability, resilience and adaptive capacity. But the attempt to specify the inter-relationships can lead to some difficult epistemological issues. Untying the Gordian knot could easily become a topic for another dissertation.

It may be helpful to helpful to return to the observation that the concepts of adaptive capacity and resilience both borrow something from the natural sciences. There is a long tradition in the social sciences of using concepts from the natural sciences as metaphors for observed social phenomena. Examples range from Herbert Spencer's use of evolution to Talcott Parsons's use of systems theory. Undoubtedly, a sociologist somewhere is currently working on an application of string theory. Researchers choose metaphors that yield insights

into the phenomenon studied. The utility of these metaphors depends upon the ability of researchers to use the metaphors to frame empirical research questions.

All social research stems from some tradition of inquiry. Researchers should acknowledge the "pre-understanding" (Ricoeur 58) that accompanies a particular tradition, and then get on with their research. Ideally, a piece of research should acknowledge and respect insights to be found in other traditions.

This dissertation is inspired by, and conceived of as a contribution to, climate change literature on adaptive capacity. But this work has been influenced by concepts from the broader hazards literature, most notably in the work of Susan Cutter. Until a consensus can emerge on the semantic issues raised by the use of these terms, we can only hope that a cross-fertilization between research traditions will contribute to the common endeavor of improving the nature of human interaction with the environment.

Reactive vs. Anticipatory Adaptation: Smith (1997) defines reactive adaptation as changes that occur only after the fact. Anticipatory adaptation requires planning and foresight to make decisions and investments before changes occur.

Autonomous vs. Strategic Adaptation: The term “autonomous adaptation” refers to adaptation that occurs by autonomous agents, rather than by collective entities, such as governments. An example of an autonomous adaptation would be a farmer deciding to plant wheat instead of corn in response to falling precipitation levels. Fankhauser et al. (1999) point out that classifying an adaptation as autonomous vs. strategic depends on the scale of analysis. For example, a group of individuals might adapt to increasing risk of extreme weather events by pooling their risk through insurance. From the standpoint of a national

government, this would look like an autonomous adaptation. From the standpoint of the individuals, however, the adaptation would be strategic and collective.

In the 1990s, adaptation options were developed in response to a variety of anticipated climate change impacts. The IPCC Third Assessment Report (2001) summarized adaptation options for several types of impacts. In response to drought conditions expected in some regions, the IPCC proposed the enlargement of reservoir capacity, construction of desalinization plants and conservation measures, among other activities.

For threats to coastal regions, including inundation, erosion, loss of wetland and heightened storm surges, IPCC noted three types of response: protect, accommodate and retreat. Protection involves constructing hard structures such as seawalls. Accommodation includes responses such as raising building heights. Retreat refers to the elimination, over time, of buildings that stand in the most high risk floodplain areas.

The use of insurance and financial tools is an important type of adaptation. Using insurance to spread risk can reduce the probability that an extreme event will have catastrophic consequences for an individual or a community. In addition, financial tools can reduce the costs of anticipated changes. For example, West et al. (2001) present a model showing how markets can discount anticipated future losses due to sea level rise.

2.3 Adaptive Capacity: Prior Literature

The emergence of adaptive capacity as a distinct field of inquiry was encouraged by the IPCC Third Assessment Report (TAR) in 2001. The Second Assessment Report (1996) noted that the ability of systems to adapt to new conditions was an important determinant of

vulnerability. However, not until TAR was a chapter devoted to adaptive capacity and its determinants (IPCC 2001, Chapter 18).

The IPCC TAR suggested that eight factors influence the adaptive capacity of systems: (1) Availability of technical options for adaptation, (2) availability and distribution of resources, (3) governance and the structure of decision making, (4) human capital, (5) social capital including property rights (6) access to risk spreading processes, (7) ability to manage information, and (8) public perception of risk

The TAR stimulated additional research devoted to testing, applying and refining the list of factors relevant to adaptive capacity. Qualitative methods have been used to explore how the eight IPCC factors affect adaptive capacity in various locales, while quantitative methods examine differences among countries.

Quantitative Studies: Examples of quantitative methods include Yohe and Tol (2002) and Adger et al. (2004). Yohe and Tol (2002) offer a quantitative assessment of the IPCC factors, particularly availability and distribution of financial resources. At the national level, they report that GDP is negatively correlated with damage caused by natural disasters. Inequality, as measured by the Gini coefficient, is positively correlated with damage caused by natural disasters. Neither economic variable is associated with the actual number of natural disasters. The authors conclude that this is *prima facie* evidence that adaptive capacity is related to economic factors.

Adger et al. (2004) propose eight determinants of adaptive capacity that overlap the IPCC factors. The eight determinants proposed by Adger et al. are: (1) Economic Well-Being, (2) Health and Nutrition, (3) Education, (4) Infrastructure, (5) Governance, (6) Geography and Demography, (7) Dependence on Agriculture, (8) Natural Resources.

Indicators are created to reflect these eight proposed determinants. For example, indicators of the first determinant, economic well-being, include GDP, Gini coefficients and national debt. The authors argue for an outcome-based approach to assessing vulnerability. Outcomes such as mortality, morbidity and displacement due to climate-related events were used as proxies for vulnerability. Regression analysis is used to analyze relationships between the eight determinants of adaptive capacity and the indicators of vulnerability. Indicators related to health, education and governance had particularly strong associations with vulnerability measures.

Qualitative Studies: Examples of qualitative approaches include Yohe and Tol (2002), Adger (2003) and Brooks et al. (2005). Yohe and Tol show how the factors proposed by the IPCC could be applied, using floodplains on the Nile and Rhine rivers as examples. For example, in the Rhine valley, access to risk spreading processes is limited, as there is no public flood insurance. The lack of risk spreading processes diminishes the viability of market-based solutions. As a result, government investment in infrastructure is more likely to be an effective solution. Thus, assessment of adaptive capacity can yield insight into the effectiveness of adaptation options.

Adger (2003) examines the relationship between social capital and government policy in Vietnam and Tobago. In Tobago, government played a key role in building the social capital of coastal communities. Stakeholders such as village councils and tourism interests were brought together for joint problem solving on issues such as reef protection. The meetings produced several forms of co-management arrangements, such as voluntary wardens to police discharges. By contrast, social capital in Vietnam, as studied by Adger, was enhanced by governmental retreat from involvement in local affairs. The retrenchment period in which

the government relaxed its control over civil society allowed village elders to assume traditional leadership roles. In an atmosphere of decentralization, village elders were successful in creating coastal defenses.

Brooks et al. (2005) conducted focus groups with experts in climate change and natural disasters. Respondents were asked to name factors that they felt would influence adaptive capacity. GDP was the most frequently suggested factor. Other factors included governance, sanitation and life expectancy.

The literature on explaining and assessing adaptive capacity suggests a need to study how adaptive capacity can be enhanced. Brooks and Adger (2004) suggest a series of questions to be used in projects aimed at assessing and enhancing adaptive capacity. The questions are organized into five sequential steps: (1) Scoping and designing an adaptation project, (2) assessing current vulnerability, (3) assessing future climate risks, (4) forming an adaptation strategy, and (5) monitoring and improving.

Brooks and Adger apply their set of questions to the Sahel region of Africa. Drought affecting rural farmers and nomads is identified as the central problem affecting the region. Adaptive measures such as government subsidies for poor farmers and construction of additional infrastructure are suggested. The barriers to adaptation mentioned are primarily at the national level: foreign debt and political instability can reduce the ability of national governments to respond effectively to the problem of drought.

Assessment: In the seven years since the IPCC TAR, much progress has been made on understanding factors related to adaptive capacity with respect to climate change. A plausible set of determinants of adaptive capacity has been proposed and refined; the list has

been analyzed qualitatively through case studies and tested quantitatively using outcome-based cross-sectional data. The lessons learned have been applied in the formation of a protocol for enhancing adaptive capacity at the national level.

The progress made to date raises additional problems that have not yet been fully addressed in climate change literature. I group these problems into three categories:

(1) The problem of scale. Neil Adger has often noted that climate change impacts and responses will occur at different scales. Adger et al. (2005) uses water management in the UK as an example. The national government requires local water companies to plan for climate change. Compliance is ensured through regulation at the regional level by the Environmental Agency. At the local level, individual water companies set prices and set policies to enhance security of water supply. Prices and policies impact individual consumers, who make decisions about water usage accordingly. This example applies as well to the United States, where the federal system requires a partnership between federal, state, regional and local governments.

Scholarship to date has not adequately explained whether determinants of adaptive capacity at the national level also determine adaptive capacity at the local level. Most studies of adaptive capacity operate only at the national level. While some progress has been made on finding factors that influence adaptive capacity at that scale, it is not clear that those same factors will influence the ability of local governments to meet challenges associated with climate change. There is a need for additional studies at scales other than the national level.

(2) Group vs. Individual: A related problem is the lack of theoretical specification regarding the relationship between individual vulnerability and group vulnerability. The explanatory factors proposed by Adger et al. (2004) offer an example. The authors suggest

that educational levels influence the adaptive capacity of places. At the individual level, it is plausible to suggest that a low level of education will diminish the ability to respond to climate related challenges. A lack of literacy will diminish an individual's ability to read about response options, for example. But it is not clear that low average education levels on the aggregate level will necessarily impede a government's ability to pursue effective adaptation strategies. The causal link between the vulnerability of an individual and the vulnerability of a place has not been specified. Needed is an explanation of the process by which individual-level characteristics affect group-level adaptive capacity.

(3) Abstract vs. Concrete: The third problem relates to the level of abstraction with which adaptive capacity is theorized. Since the IPCC TAR, a typical method of investigation has been to start with a set of factors thought to be related to adaptive capacity in general, and then to test these factors for association with outcomes related to adaptive capacity. Thus, Yohe and Tol (2002) begin with the hypothesis that economic well-being is conducive to adaptive capacity in general. The hypothesis is tested by correlating GDP with climate-related mortality. The positive correlation leads to the conclusion that economic resources are associated with adaptive capacity in general.

A different approach would be to start with a specific type of successful adaptation, and seek out factors to explain why communities differ in their ability to adopt that specific adaptation. For example, why was one agricultural community able to change crops in response to changing precipitation, while another was not? Or, why did one coastal community successfully use risk-spreading mechanisms, while another did not?

An approach like this avoids adaptive capacity as an abstract concept, looking instead at the capacity of communities to adopt specific adaptations. A study of this kind would be a useful complement to generalized analyses of adaptive capacity.

2.4 Hazard and Vulnerability Literature

The theoretical gaps observed in studies of adaptive capacity have parallels in the broader literature on hazards and vulnerability. While a comprehensive discussion of vulnerability is beyond the scope of this review, a look at the recent work of Susan Cutter shows that the tensions observed in the adaptive capacity literature have not been entirely resolved in the broader literature.

Literature on vulnerability to hazards addresses both biophysical and socio-economic components. Cutter (1996) catalogues eighteen definitions of vulnerability that have been offered. These definitions are grouped into three broad themes. Those who define vulnerability as a *pre-existing condition* tend to emphasize biophysical conditions that place communities at risk. By contrast, defining vulnerability as a *tempered response* places a greater emphasis on the resistance and resilience that societies show in the face of threats. A third type of definition, which Cutter labels *hazard of place*, contains elements of the other two, with more explicit geographic references. Cutter argues for a hazard of place approach that sees the vulnerability of a place as the product of biophysical hazards mediated by the geographic context and the social fabric.

Cutter et al. (2003) operationalizes this approach, assessing the vulnerability of U.S. counties. Using county-level census data, the authors place 40 indicators of vulnerability into a principal components analysis (PCA). These indicators include race, age gender and

income. The PCA extracted 10 factors that accounted for 82% of the socio-economic variability of U.S. counties. Finally, the factors were placed into an additive model to derive an overall social vulnerability index score (SoVI) for each county.

Boruff, Emrich and Cutter (2005) combine physical and socio-economic factors to arrive at an overall assessment of vulnerability. To assess physical vulnerability, the authors use the U.S. Geological Survey's Coastal Vulnerability Index (CVI), which divides the coastline into line segments, and assigns a score of 1 through 6 to each segment, with 6 being most physically vulnerable. To assess social vulnerability, the authors essentially borrow the SoVI outlined in Cutter (2003). To combine physical vulnerability and social vulnerability into a composite vulnerability assessment, the authors derive z scores for both the CVI and the SoVI, then add the physical and social z scores together. OLS is used to determine whether physical or social vulnerability contributes most to overall vulnerability. The authors used the aggregated score to determine which counties in the U.S. are most vulnerable to coastal erosion.

Cutter's work shows that vulnerability literature has addressed multiple levels of scale in a way that has scarcely been done in work on adaptive capacity. Cutter performs vulnerability analysis on the county level; most adaptive capacity literature addresses the national level.

However, Cutter's work reveals the same lack of theoretical specificity regarding the relationship between individual and group vulnerability. While Cutter et al. are undoubtedly correct to note that low income persons, persons of color, and women generally face disadvantages in American society, it is not clear how these individual-level characteristics affect the vulnerability of groups or communities. Needed is an explanation of the process by which social risk factors mediate geophysical hazards. For example, it is not clear *how* a

large non-white population puts a community at increased risk of coastal erosion. The causal link is not direct.

Cutter's approach, like that of most quantitative studies of adaptive capacity, neglects the agency of local decision makers. The American system of hazard management requires effective leadership at the federal, state and local level. As Mitchell (2006) has noted, "partnership has long been a central motif of U.S. public policies formulated in response to natural hazards, disasters, and catastrophes" (237). While the fragmented nature of the American system can lead to chaos, it also creates an opportunity for effective local leaders to leverage federal resources. There is no a priori reason to assume that a community with a 20% poverty rate will be less able to access federal resources than a community with a 10% poverty rate. The menu of capabilities available to local leaders is not entirely determined by the demographic make-up of the communities they serve.

2.5 Adaptive Capacity and Social Theory

The literature review above suggested some future directions for research into the adaptive capacity of places. First, there is a need for more studies at a scale smaller than the national level. Second, the study of adaptive capacity could be improved with a stronger theoretical linkage between individual and group vulnerability. Finally, there is a need for greater specificity in the study of adaptations: In addition to studying adaptive capacity in general, we should also study capacity to adopt specific types of adaptation.

The problem of agency lurks beneath each of the gaps identified above. When dealing with the vulnerability or adaptive capacity of places, it is necessary to examine who makes decisions, and how decision makers are constrained or empowered. These are the types of

problems considered by such social theorists as Amartya Sen and Anthony Giddens. In this section, I argue that the assessment of adaptive capacity could be strengthened by the insights of these two theorists.[2]

The work of Sen (see Nussbaum 2003) and Giddens (1984) point the way toward a resolution of the problems raised in existing vulnerability literature. Sen builds his ethical system around the concept of capabilities. Capabilities represent the different combinations of functions that a person can choose or achieve. Sen's fundamental insight is that in a crisis, what matters most is not the resources available, but rather what the individual or community is able to do with those resources. The menu of things that a person can do with the resources available to him represents the range of capabilities available to that person.

For this reason, Sen argues that aggregate measures of wealth and inequality can be misleading. Focusing on GDP growth in a developing country neglects the question of whether the people in that country have more or less freedom to achieve satisfying lives.

In the context of sea level rise, a capabilities approach would move away from national or county-level aggregates, and focus instead on the following questions: Can an individual protect his property by erecting a bulkhead or other armoring device? Can she move away from danger zones? Can he spread his risk through insurance? Can she rationally shape her purchasing decisions to discount future risk of property loss? At a community level, can individuals work collectively to protect public goods such as beaches or wetlands? Can a community leverage the resources needed for large-scale engineering projects?

Capability theory raises the issue of choice. Rather than assessing vulnerability based on an individual's income, race or gender, we should examine how the choices the individual

[2] I owe an intellectual debt to Frolich, Corin and Potvin (2001), who apply structuration theory to somewhat similar problems in the field of epidemiology.

makes are structured by the situation she is in. When can individual actors respond to SLR? When is a collective response necessary? What factors constrain the ability of individuals to act? These questions are at the heart of the structure/agency dilemma.

Reconciling the relationship between social structure and individual choice is perhaps the central issue in social theory. Social structure refers to institutions, power relations and class distinctions that shape individual lives. Agency refers to the ability of individuals to choose actions. Early social theorists such as Durkheim (1997) and Marx (1978) gave precedence to social structure, viewing individual choice as epiphenomenal. Methodological individualists, represented by the Austrian school of economics, explain social phenomena as the outcomes of individual decisions.

Giddens (1984) offers a resolution of the structure/agency debate through his structuration theory. For Giddens, a social structure is simply a repeated pattern of interaction or behavior. Individuals reproduce social structures by going through their daily routines.
But individuals can also transform social structures by changing the way that they go about their lives. The ability of individuals to transform social structures is limited. For example, most people cannot choose to go without cars, even if they find auto-dependence a social tragedy But individual choices can change seemingly intractable social structures. For example, the decision of individuals to change their grocery buying habits is credited with leading to an improvement of conditions for grape pickers in the 1960s. Structure and agency, then, exist in a recursive relationship. Individual choices are constrained, but potentially transformative. (One weakness in structuration theory is that Giddens never explains *when* individual agency can be transformative.)

Structuration theory offers a useful set of tools for adding to our understanding of adaptive capacity. It recognizes that individuals exercise agency through practices, and further sees that practices are shaped by structure in a recursive fashion. This viewpoint actually makes the discussion of adaptive capacity less abstract: The traditional study asks what factors determine the adaptive capacity of a society in general. The structuration approach asks why actors are (or are not) able to implement a particular adaptation in a specific place. Traditional approaches attempt to isolate elements in the social structure that are associated with adaptive capacity; structuration asks us to explain the process by which structural elements constrain actors. Finally, structuration theory recognizes that scale matters, as individual choices are shaped by local conditions, and local decision makers in turn are constrained by regional and national conditions.

2.6 An Example

Suppose we are interested in understanding why some flood-prone communities in a drought-stricken area are able to implement effective floodplain management practices, while others are not. Such a question would be unusual in studies of adaptive capacity, both because of the local scale and because of the level of specificity regarding the adaptation in question. A typical quantitative study might develop a statistical model incorporating group-level variables, such as education or income, that would partially explain the relative level of adaptive capacity.

Such a study, however, would not explain how the adaptation came to be differentially distributed, or how the macro-level variables were translated into different practices. Structuration theory would suggest an analysis of the relationship between structure and

practices in those communities to understand how the relationship affected adaptation decisions.

An outline of a structuration-informed study would contain the following elements: First, the requirements of the adaptation must be noted. These might include financial resources for hardware and for enforcement. Local officials would also need information about available practices, and some level of technical expertise to carry them out.

Financial resources in a community would be worth examining, but would not be determinative. A poor community might be able to leverage resources from state or national governments. A rich community with fierce anti-tax beliefs might be unable to take effective collective action. Other factors that might affect implementation might include the level of professionalism among municipal employees, the openness to innovation in the locality's political culture and social networks between local decision-makers and external experts or colleagues.

The best analysis would be one that includes both quantitative and qualitative elements. Quantitative analysis may be used to look for associations between elements in the social structure and adaptation practices. Qualitative analysis would complement this approach by explaining how structural elements constrain or empower adaptation decisions.

This approach differs from a traditional vulnerability assessment in that it examines the social practices related to adaptation in an attempt to understand how adaptation is adopted (or not) in an area; what rules and resources decision makers draw on to make adaptation decisions, and the ways in which decision makers, through their practices reinforce these rules and resources. Together, these aspects offer an understanding of the structuration of adaptation in different communities. In subsequent chapters I hope to show that this

analytical tool may enhance our understanding of why adaptations are distributed differently across areas, and that it may also be useful for enhancing the adaptive capacity of communities.

Chapter 3: Background on the National Flood Insurance Program and the Community Rating System

In the previous chapter, I argued that the study of adaptive capacity should focus on specific practices. This chapter, details some of the specific practices to be examined in subsequent chapters. The focus is on practices associated with participation in the Community Rating System (CRS), which is part of the National Flood Insurance Program (NFIP).

The outline for this chapter is as follows: Section 3.1 outlines the NFIP program. Section 3.2explains how the CRS program works. Section 3.3 uses floodplain management in Ocean City, New Jersey as an example of how the program operates. Finaly, Section 3.4 argues that CRS participation is a reasonable proxy for adaptive capacity.

3.1 The National Flood Insurance Program

Federal involvement in flood protection began in 1879 with the creation of the Mississippi River Commission. Over the next half century, the Commission built a system of levees to protect towns along the river. The floods of 1927 overwhelmed the levee system, and undermined the legitimacy of the Commission (King 2005).

The Mississippi River flood of 1927 spurred Congress to pass a series of measures between 1928 and 1936 to authorize the construction of flood control structures. In 1936, Congress authorized the President to provide post-disaster relief. There was not a system established to provide this assistance, however, and the form of disaster relief was contingent upon political negotiation. Structural flood control dominated federal policy related to flooding until the 1960s.

NFIP was created by the National Flood Insurance Act of 1968. The program was originally part of the U.S. Department of Housing and Urban Development (HUD). It was transferred to the Federal Emergency Management Agency (FEMA) in 1979. In 2003, NFIP, along with the rest of FEMA, became part of the new U.S. Department of Homeland Security (U.S. Department of Homeland Security 2006a).

The 1968 legislation cited three primary goals: (1) To protect individuals from catastrophic flood losses; (2) to reduce flood damage by promoting sound planning and floodplain management; (3) to reduce federal disaster relief spending. A key section of the law restricted NFIP availability to communities that practiced sound planning principles, as defined in federal regulation (King 2002).

A central rationale for the 1968 law was that private flood insurance was often not available. The unavailability of private insurance was seen as a market failure, since it was caused by the problem of negative selection: In general, only the most high-risk properties would purchase flood insurance. This made it difficult to spread risk in a manner that would allow insurance companies to accumulate sufficient capital to pay off catastrophic losses (U.S. Department of Homeland Security 2006b, Appendix B).

To solve this problem, NFIP offered insurance only in communities with adequate floodplain management practices. By restricting development and enforcing construction standards in floodplains, communities could reduce the probability of catastrophic losses, thus allowing effective risk pooling.

The law also directed FEMA to create Flood Insurance Rate Maps (FIRMs), to indicate the location of floodplains. In a move that would have actuarial consequences a generation later, the law established subsidies for buildings located in floodplains. These buildings were

known as "pre-FIRM" structures. The reason for the subsidies was a belief that it would be unfair to require owners of buildings to pay full insurance rates when the structures were built before the flood risk was understood. The authors of the law also apparently believed that time would naturally reduce the number of buildings in floodplains. By the turn of the century, it would become clear that subsidized pre-FIRM structures would draw a disproportionate amount of underwriting expenses, while diminishing the revenues collected from insurance premiums (U.S. Government Accountability Office 2005a).

NFIP was strengthened by the Flood Disaster Protection Act of 1973. This act prohibited federal disaster assistance in communities that did not participate in NFIP. In addition, the act created areas known as Special Flood Hazard Areas (SFHAs). Any land within a 100 year floodplain was considered to be within a SFHA. Banks and other federally insured lenders were barred from offering mortgages in SFHAs for any structures that were not insured through NFIP. In effect, this meant that a home in a SFHA could not be bought or sold unless it had flood insurance. One loophole in the law is that home owners could allow flood insurance to lapse a year after purchasing the home (U.S. Department of Homeland Security 2002).

The 1973 law increased participation in NFIP significantly. Between 1973 and 1977, the number of participating communities rose from 2,200 to over 15,000. The number of insurance policies jumped from 95,000 to 1.2 million (U.S. Department of Homeland Security 2002).

Two significant additions were created by the National Flood Insurance Reform Act of 1994. First, the law added penalties for lenders that were not complying with provisions of the 1973 law. Second, the Community Rating System (CRS) was codified. CRS offered

discounts on flood insurance rates to individuals with property in communities that exceeded the minimum standards for participation in NFIP (FEMA 2002).

A final major reform came with the Flood Insurance Reform Act of 2004. The law, nicknamed the "two floods and you're out" bill in the House of Representatives, offered assistance to owners of repetitive loss structures. The assistance is to be used for either removing the structure from the floodplain, or for elevating the structure to prevent future loss. Owners that do not take advantage of this assistance now are to pay full actuarial costs for their insurance (Bunning-Bereuter-Blumenauer Flood Insurance Reform Act 2004).

Home owners purchase NFIP policies from private insurance agents, who represent insurance companies that voluntarily offer and service NFIP products. The cooperative arrangement between NFIP and private insurance companies was created in 1983, and is known as the Write Your Own (WYO) program. Companies must charge rates set by NFIP, and may collect an expense allowance for policies processed (U.S. Department of Homeland Security 2006c). Privatizing the issuance and servicing of NFIP policies is considered a cost-saving measure for NFIP. Companies that issue and service NFIP policies must adhere to all program regulations, and NFIP underwrites all policies sold through private insurance agents (U.S. Department of Homeland Security 2005).

According to the General Accounting Office (GAO 2005a), NFIP has approximately 4.6 million policy holders in 20,000 communities. Prior to Hurricane Katrina, it had paid about $14.6 billion in claims over the life of the program. Although NFIP pays its claims using revenues from insurance premiums, GAO finds that it is not actuarially sound because 29% of all insurance premiums are subsidized in order to encourage participation. NFIP is

authorized to borrow from the U.S. Treasury to pay claims when premium revenues are insufficient.

Hurricane Katrina, in September, 2005, posed a major challenge for NFIP. According to the GAO, flood insurance claims related to Katrina exceeded $23 billion, more than the entire cost of NFIP since its inception. Without cash reserves to cover the losses, NFIP was forced to borrow $18.5 billion from the U.S. Treasury.

An important criticism of NFIP, as with other forms of insurance, is that it creates the problem of moral hazard (U.S. Congress 2006). By reducing the consequences of a disaster, NFIP may encourage individuals to build structures in inherently risky areas. Until Hurricane Katrina, NFIP supporters argued that the program was self-supporting through insurance premium revenue, and did not require taxpayer dollars to cover losses. However, the GAO (2005a) has concluded that the program is not actuarially sound because of reduced rates offered to pre-FIRM structures. NFIP supporters also note that the program provides virtually the only incentive for municipalities to adopt sound planning practices, and that therefore flood damage would be much greater without NFIP.

3.2 Community Rating System

CRS was introduced in 1990, and codified into statute in 1994. CRS promotes effective floodplain management by reducing flood insurance rates in communities that exceed minimum NFIP standards. The program operates on a point system. Communities earn a designated number of points for activities that reduce flood risk, enhance flood preparedness, or improve public awareness. For each 500 points earned by a community, flood insurance rates are reduced by 5% (U.S. Department of Homeland Security 2006e).

There are nine levels of participation, with Level 1 representing the highest level of participation to which a community may aspire. Currently, Roseville, California is the only community in the country to reach CRS Level 1. The next three leaders are Tulsa, Oklahoma at Level 2, King County, Washington at Level 3, and Fort Collins, Colorado at Level 4. The number of participants at other levels is shown in Table 1.

Table 3.1 Number of Participants by CRS Level

CRS Level	Number of Communities
1	1
2	1
3	1
4	1
5	33
6	80
7	206
8	421
9	301
Total	1,049

Source: U.S. Department of Homeland Security, 2006e

CRS participation requires municipalities at a minimum to create an approved plan to eliminate repetitive loss structures and to enact into ordinance height requirements for new structures. Beyond these steps, municipalities are required to choose from a list of options, each with assigned point values. Table 2 shows maximum credit points awarded for CRS activities. Also shown are the percentage of CRS communities, across the nation that participate in each type of activity and the average number of points earned for each activity (U.S. Department of Homeland Security 2005c).

To create a floodplain management plan as required by CRS, communities must establish a floodplain management committee. Committees usually consist of local government officials, developers and other concerned citizens. Committees are initially responsible for assessing the community's flooding problems and setting goals for achieving CRS points.

Once a plan is developed, the committee meets at least once each year to review progress, and to establish new goals.

Table 3.2 Credit Points for CRS Activities

Activity	Maximum Points Possible	Average Points Earned	Maximum Points Earned	Percentage of Communities Credited
Elevation Certificates	162	72	142	100
Map Information	varies			100
Outreach Projects	315	80	290	79
Hazard Disclosure	81	21	81	54
Flood Protection Information	66	22	30	85
Flood Protection Assistance	71	57	71	42
Additional Flood Data	1373	56	430	26
Open Space Preservation	900	113	954	86
Higher Regulatory Standards	2720	100	766	78
Flood Data Maintenance	231	66	218	68
Stormwater Management	670	105	446	79
Floodplain Management Plan	309	79	220	14
Acquisition and Relocation	3200	140	2084	9
Flood Protection	2800	43	384	5
Drain System Maintenance	330	261	330	77
Flood Warning Program	225	101	200	29
Levee Safety	900	154	520	1
Dam Safety	175	66	100	91

Source: U.S. Department of Homeland Security, 2006e

Since CRS communities are required to enact height ordinances for SFHAs, local governments must issue elevation and floodproofing certificates for all new structures. Copies of certificates must be kept on file for inspection by insurance agents and other interested parties. Electronic copies are acceptable. Elevation certificates must also be maintained for substantially renovated structures.

In addition to the points requirement, some CRS levels require additional measures. In order to reach Class 7, communities must receive a classification of 6 under the Building Code Effectiveness Grading Schedule (BCEGS). The Class 6 BCEGS rating must be achieved for both residential and commercial building code.

To achieve CRS Level 4, a community must receive a BCEGS classification of 5 for both residential and commercial buildings. The community must also adopt freeboard regulations that earn at least 100 CRS points. A freeboard requirement is a regulation that expresses flooding risk for a structure in terms of feet above flood level. In addition, the community must earn at least 105 points for stormwater management activities, and 250 points for higher regulatory activities. Finally, a community must achieve at least half of the points available under floodplain management activities. To achieve CRS Level 1, communities must protect all new construction to the 500 year flood level. Among other requirements, communities cannot achieve a Level 1 rating if more than 25% of at-risk structures are repetitive loss structures. To reach Level 1, communities may achieve the required percentage by acquiring repetitive loss structures, raising the height of these structures, or by building levees or other flood control structures. A final noteworthy requirement for Level 1 status is that communities must prepare a multi-hazard mitigation plan that addresses all natural hazards in the community.

A community's compliance with CRS rules is verified by the Insurance Services Office (ISO), a private company located in Jersey City, New Jersey (Washington Department of Ecology 2006). ISO was established in 1971 as a professional association. Its mission is to provide legal, statistical and actuarial information to the insurance industry. In 1997, ISO became a private company, and continues to maintain a virtual monopoly as a seller of certain types of information to the insurance industry (Insurance Services Organization 2006). ISO staffs at least one CRS/ISO coordinator in each state (U.S. Department of Homeland Security 2006e, Appendix G). The CRS/ISO coordinator serves as a resource to

communities that participate in CRS. The CRS/ISO coordinator also inspects records and other data to verify that communities are entitled to CRS points claimed.

To apply for CRS points, a community must submit documentation to the ISO. The CRS/ISO coordinator reviews documents and determines whether the documentation is sufficient to justify the points claimed by the community. Once the CRS/ISO coordinator determines that a community is entitled to a certain point level, a verification visit is scheduled. At the verification visit, the CRS/ISO coordinator inspects both documents and structures. ISO notifies FEMA of its findings, and FEMA issues a CRS certificate to the community (U.S. Department of Homeland Security 2006e).

Communities are periodically reviewed to ensure that they continue to meet CRS standards (U.S. Department of Homeland Security 2006f). Communities participating at Levels 6 through 9 are reviewed every five years. Communities with a rating of 1 through 5 are reviewed every three years. CRS ratings and discounts are rescinded in communities that fail to maintain standards. New Jersey had 22 rescinded communities on the CRS list in May 2005, and about twice that number on the list of active participants (U.S. Department of Homeland Security 2006e).

3.3 Ocean City

Ocean City is a coastal community located in Cape May County. Its year-round population is about 15,000, although the summertime population can exceed 100,000. The town sits on a barrier peninsula, and the entire city has been designated a Special Flood Hazard Area (SFHA). The town is predominantly white and has a median household income of $44,000 (U.S. Census 2000).

Ocean City joined the National Flood Insurance Program (NFIP) in 1970, and began participating in CRS in 1991 (Hollingsworth 2006). According to city employees, a FEMA representative approached Ocean City around 1990 to encourage local officials to take part in CRS. Ocean City had been hit by several storms in the 1980s, and caught the attention of FEMA because of the number of repetitive loss structures in the town. The city's environmental officer met with FEMA officials, and became the champion of the CRS program within Ocean City. City employees conducted presentations on CRS before the City Council and conducted public outreach to inform the public. The City Administrator embraced the program and provided high-level backing.

CRS is part of the emergency management department in Ocean City, although several agencies make CRS participation a high priority. The CRS coordinator position in Ocean City is a full-time job. By contrast, many of Ocean City's neighboring municipalities simply add CRS duties to another staff position.

Ocean City adopted a floodplain management plan in 1997, and achieved a CRS Level 8 later in the same year. The city moved up to Level 7 in 2005. In 2006, city officials reported that participation in CRS was saving Ocean City property owners over $1.25 million each year. In 2006, there were 16,112 active NFIP policies in Ocean City . Collectively, these policyholders paid $7.1 million per year in flood insurance premiums (FEMA 2007).

The following discussion provides detail on the steps taken by Ocean City to achieve the Level 7 rating, and on subsequent steps taken in 2005 and 2006 as the city aimed for a Level 6 rating.

Ocean City based its application for a Level 7 rating on the successful achievement of

twelve objectives (ISO 2005). The city's attainment of its goals was verified by the ISO in a visit conducted on May 17, 2005. Exhibit 3.1 summarizes the points awarded for each activity, as verified by the ISO.

Exhibit 3.1: Summary of Ocean City Floodplain Management Action Plan

Elevation Certificates: NFIP requires participating communities to adopt an ordinance that requires all new or substantially improved buildings within a SFHA to be elevated above the base flood elevation. As noted above, all of Ocean City lies within an SFHA, and so the ordinance applies to all construction in the City.

The utility of an elevation certificate is maximized when it is easily accessible by lenders and insurers. Thus, Ocean City was able to claim 56 CRS points for maintaining elevation certificates, keeping them on file, and making them available for public inspection. City officials report that this is a major time commitment, as the city has approximately 3000 elevation certificates on file, and adds an additional 200-300 each year.

Map Information: The city claimed 140 CRS points for making up-to-date information from local Flood Insurance Rate Maps (FIRMs) available to the public, and for publicizing the service. FIRMs are a useful tool in real estate transactions. Making flood risk known to buyers provides an incentive for sellers to elevate or otherwise floodproof their properties.

Outreach Projects: Ocean City was awarded 180 points for its public outreach. Brochures are mailed to each household annually to inform property owners about flood risk and mitigation options. The brochure is also made available in disaster kits distributed in public locations. Similar materials are on display in the city hall.

In addition, Ocean City conducts several public presentations annually. For example, in 2005, the City brought in Steve Lyons, a meteorologist from the National Weather Service to give a public presentation on hurricanes. CRS officials report that setting up and staffing public outreach events is one of the biggest time commitments involved with the program.

Flood Protection Information: An additional 30 points were awarded for making documents related to floodplain management publicly available in the Ocean City public library.

Open Space Preservation: The single largest block of CRS points was awarded for Ocean City's efforts at open space preservation. The city earned additional points for making its open spaces deed-restricted, to ensure that open space areas are protected in the long term. About 1,644 acres, or 37% of the town, is protected open space, including the beach and dune areas. Ocean City receives 354 CRS points for its open space preservation policies.

Regulatory Standards: Ocean City was awarded 123 points for adopting a building code that exceeds the minimum standards for NFIP participation. All communities in New Jersey receive a uniform credit because of the state's Uniform Construction Code (UCC). The UCC incorporates the International Building Code 2000 (NJAC 5:23).

Ocean City also received credit for participation in the Building Code Effectiveness Grading Schedule (BCEGS). BCEGS is a voluntary program in which ISO assesses the effectiveness of a city's building code, including enforcement. BCEGS was developed by ISO in conjunction with the Insurance Institute for Property Loss Reduction. Under the program ISO assesses the manner in which the city administers codes, reviews building plans, and conducts field inspections. Assessment criteria include staffing levels, qualifications of key staff, training and public awareness. BCEGS awards communities grades ranging from 1 to 10, with 1 being best. Ocean City received a grade of 4 for both its residential and commercial programs.

Finally, Ocean City received CRS points for prohibiting the use of septic systems. Floods can damage septic systems, and cause them to release harmful chemicals and pathogens.

Flood Data Maintenance: Ocean City received 96 points for maintaining copies of old FIRMs, and for creating a system of elevation reference marks. Reference marks are used by surveyors, and facilitate the accurate measurement of building elevations. The reference marks use the same datum as Ocean City's FIRM, and are made readily available to the public.

Erosion Control: Ocean City receives 37 points for enforcing New Jersey laws relating to soil erosion and sediment control. The rules for implementing the Soil Erosion and Sediment Control Act of 1976 are found at NJAC 2:90-1. Under state regulations, projects that disturb more than 5000 square feet of land must obtain a Soil for control and appropriate removal of sediment, grading that does not cause erosion problems, and creation or maintenance of vegetative cover.

Floodplain Management Planning: Ocean City receives 196 points for adopting and maintaining a floodplain management plan. The plan and its implementation will be discussed in more detail below. In brief, the plan incorporates 40 different elements and is reviewed annually by a floodplain management committee comprised of officials from multiple departments, as well as members of the public.

Drainage System Maintenance: Each part of the drainage system in Ocean City is inspected daily, and debris is removed promptly. Reports are maintained for both inspection and maintenance. Ocean City also prohibits dumping into the drainage system. Two hundred and eighty CRS points were awarded for this category.

Flood Warnings: Ocean City earned 170 points for its flood warning system. Activities included establishing multiple methods of monitoring storm data and of disseminating local warnings. In addition, Ocean City conducts public presentations at least twice each year, and city officials visit National Weather Service (NWS) offices at least once each year. Ocean City has been designated a Storm Ready Community by the NWS.

Dam Safety: All cities in New Jersey are awarded 67 points for the state's dam safety program.

The current floodplain management plan in Ocean City was adopted in 1997 (City of Ocean City 2005a). A Floodplain Management Committee meets each August to review the plan, agree on action steps, and issue a report on the previous year's activities. Exhibit 3.2 gives a discussion of the key elements of the plan, with special attention given to the issues discussed in the Committee meeting of August 3, 2006.

Exhibit 3.2: Summary of the Ocean City Floodplain Management Plan

Plan and Study: Two of the items in the 1997 plan related to a project undertaken by the New Jersey Department of Transportation (NJDOT) to improve Route 52. The project involved a reconstruction of a 1.5 mile causeway connecting Ocean City to the mainland. The plan called for working with NJDOT in the planning of the construction project. In addition, the plan called for studying the elevation of roadways that could be used as evacuation routes. To these ends, the City Council appropriated $200,000 to study the elevation of roadways connecting to the causeway. The planning effort helped the City secure state funding to have the projects done.

The need for secure evacuation routes figured in two other study items. The plan called on the City to support studies to identify areas that could be isolated due to road elevation. Identifying these areas would allow for timely pumping, if necessary. This study was ongoing as of August, 2006. In addition, the plan called for planning staff to prepare amendments to the Master Plan to recommend evacuation routes. This item was completed in 2004.

One beneficial study was the analysis of possible reuse opportunities for dredge materials. This study resulted in the use of dredge materials to re-sculpt the municipal golf course.

A significant planning item discussed in the committee meeting was the need to produce guidelines on permeable surfaces, to be distributed to building contractors and other interested parties. The committee hoped that the development of such a list would influence future ordinances. This study was ongoing in 2006, with committee members citing a need for data from the Cape May County government.

Another item related to impervious surfaces was a call for the city government to analyze all projects to minimize the use of impermeable concrete surfaces. Since adoption of this action item, committee members believed that the city had significantly increased its use of porous paving materials.

Some of the studies were more local in nature. A study of flooding on Haven Avenue was completed in 1999. An ongoing study was an analysis of flooding from the wetlands south of 24th Street.

Ordinance and Regulation: The plan called for the administration to draft two ordinances for consideration by the City Council. One ordinance, establishing a minimum bulkhead height of eight feet, was enacted in 1999. A second ordinance remained in the drafting stage in 2006. This item called upon planning staff to prepare an ordinance to prohibit stones and concrete in lawns, and to require vegetation only in right-of-ways.

Outreach: The plan called upon the administration to conduct several different types of outreach to inform the public about flood protection. In 2000, a FEMA grant enabled the City to undertake a program to promote the floodproofing buildings, including the use of structural elevation. The grant was ultimately used to elevate 13 properties. A separate and ongoing action item in the plan calls upon the administration to continue seeking opportunities to help property owners to elevate buildings.

Several public programs were created pursuant to the plan. An annual flood awareness event presents speakers on topics related to flood and storm safety. Workshops with the City Council and other community leaders have been held with experts from FEMA and the NWS. Information about CRS is included in yearly tax bill mailings. The library is kept stocked with pamphlets and current documents related to floods and floodproofing. Finally, a website was established to keep citizens up-to-date on developing weather. Outreach related to evacuation procedures included the recruitment of store owners and post office workers to post and relay information to customers, as well as improving signage on evacuation routes.

Staff Time: Several items required little in the way of capital expenditures, but did require organizational resources and staff time. An example is the 1997 project to develop a new one foot contour topographic map to show current floodprone areas. This was completed by an intern, supervised by a staff in the planning department. Another example was a brainstorming session that brought different City departments together with concerned citizens.

A major time investment is the ongoing inspection and maintenance of the drainage system, along with the attendant record keeping. City employees track the cleaning of storm drains on a daily basis to reduce the risk of flooding due to overflow.

The enforcement of ordinances as prescribed by the plan presented some problems. The plan calls for the zoning officer and the concrete inspector to enforce City ordinances relating to impervious surfaces. Committee members reported that this was a "very big problem," due to non-compliance. Another enforcement problem pertained to pile drivers. Pile driving is a construction technique that involves driving a reinforced column into the ground for use as a foundation. Pile drivers require a fairly clean and flat surface on which to operate. The clearing of ground in preparation for pile driving can lead to erosion and sediment control problems. To solve the difficulty in enforcing relevant City ordinances, the committee decided upon a dual program of educating the police on the proper use of pile drivers, and educating contractors on the proper use of bales of hay to control sediment.

The Community Development Agency and the Public Works Department agreed to work together to process and remediate citizen complaints related to flooding. The plan calls upon City staff to keep up to date on technology. Finally, the plan calls for ongoing support for Geographic Information Systems.

Public Works: The plan describes several construction or public works activities that involved capital expenses. Following are some of the most significant items:

- The City installed geotubes to protect beaches from erosion at the end of March, 2006. Committee members gave this action credit for saving the beaches from catastrophic erosion the following month. The geotubes consist of a durable fabric filled with sand.
- Emergency Management staff maintain a link to telemetry data obtained from buoys that measure water height in the bay.
- The City installed a new warning siren.
- As noted above, the City was able to elevate streets in the vicinity of the wetlands with assistance from a grant from NJDOT.
- The plan calls for ongoing replacement of elements in the drainage system, including pipes, drains and valves.

3.4 CRS Participation and Adaptive Capacity

Participation in CRS reveals much about a community's capacity to respond to challenges posed by climate change. To successfully participate in the program, a community's leaders must possess several traits. The things required of community's leadership might be classified as expertise, attitudes and competencies.

To participate in CRS, particularly at higher levels, a community must marshal expertise in several different fields. Knowledge of engineering, public safety, construction, data management, public relations and law are all required of participants.

A core competency required of CRS participants is the ability of community leaders to form partnerships. First, within a city government, partnerships must be formed between different departments. In Ocean City, productive partnerships were observed between the Police Department, the Fire Department, the Planning Department, Public Works and Emergency Management. Second, the CRS program requires a partnership between local and federal officials; cooperation with state and county officials also enhances a community's rating. The City has shown the ability to maintain these relationships through its ability to access federal and state grants for structural improvements. Finally, cooperation between

city officials and non-government actors is required. For example, a representative of the Board of Realtors played a constructive role on the floodplain management committee.

The ability to participate in CRS also reveals something about the attitudes of leaders, or more broadly about the political culture of a community. To participate, leaders must recognize the risk that flooding poses to a community, and must place some value in the use of insurance to spread risk. Participation requires a willingness to regulate private behavior in order to reduce vulnerability in the community as a whole. More broadly, CRS participation reveals a political culture in which proactive problem solving is valued.

For these reasons, participation in CRS is a good indicator of adaptive capacity at the municipal level, and thus constitutes an area of study relevant to hazard vulnerability in general, and climate change/SLR vulnerability in particular.

Chapter 4: Quantitative Analysis of the Relationship Between Socio-Economic Status and Adaptive Capacity at the Community Level

4.1 Introduction

The purpose of this chapter is to test the hypothesized relationship outlined in Chapter 2 between individual vulnerability and group vulnerability. Following is a recapitulation of the hypothesis to be tested and the rationale for doing so.

Previous literature has tended to assume a relationship between the vulnerability of individuals and the vulnerability of groups. For example, it has been assumed that communities with high numbers of persons in poverty or a high percentage of racial minorities will have lower levels of adaptive capacity than communities with fewer vulnerable individuals. In chapter 2, I argued that the relationship between individual and group vulnerability was unclear, and that assumed relationships have not yet been tested quantitatively at the municipal level. In addition, quantitative tests done at the national level have used proxies for adaptive capacity very general, such as disaster-related deaths. There is a need for studies that look at the adoption of specific adaptive practices in specific places. The quantitative evidence presented in this chapter was assembled for the purpose of filling these lacunae in the literature.

In chapter 3, I argued that municipal participation in the Community Rating System (CRS) program is a good proxy for adaptive capacity at the community level. CRS offers discounts on National Flood Insurance Program rates to communities that use proactive floodplain management practices. Thus, my central method is to test associations between CRS participation and indicators of socio-economic status at the municipal level.

One issue faced in designing this study was whether to use participation at any level as a proxy for adaptive capacity, or whether to restrict focus to cities that achieved participation at a level 7 or higher. My conclusion was that it is valid to consider participation in CRS, even at low levels, as a proxy for adaptive capacity. If two cities face a similar level of risk, and only one of those cities participates in the CRS program, then it seems reasonable to conclude that this city exhibits a greater level of adaptive capacity. But the ability to maximize flood insurance discounts by participating in CRS at higher levels is also a powerful indicator of adaptive capacity. In the end, I tried both approaches, and found the results to be consistent. The construction of dependent variables is detailed in section 4.2, below.

The central finding of this chapter is that the probability that a community will participate in CRS is associated with the socio-economic status of individuals in that community. High average income and education levels in a community increase the probability that a community will participate in CRS, holding risk constant. Large numbers of persons in poverty, and large concentrations of minorities, appear to make cities less likely to participate in CRS. The presence of a city manager form of government does not appear to alter this relationship. Also, the relationship between SES and adaptive capacity persists even after controlling for differences in municipalities' fiscal capacity. The probabilistic relationship between SES and CRS participation is not affected by the way in which CRS participation is measured. The finding is also robust regardless of whether probit, OLS or tobit models are used.

In the following section I describe in turn the dependent and independent variables employed, the sources of data, and the types of models used to test hypotheses.

4.2 Data and Methods

Dependent Variables: I use CRS participation as a proxy for adaptive capacity. There are several ways that CRS participation can be coded. Municipalities participate in CRS at different levels; those with more effective floodplain management practices receive larger discounts through CRS. The different levels of participation yield several different measures that can be used as dependent variables.

I began by constructing dummy variables to indicate various levels of CRS participation. The most elite participants in the CRS program are those that participate at levels 1 through 6. These communities receive discounts ranging from 20% to 45%. Thus, the first dummy variable, L16, is coded 1 for these high-level participants, and 0 for all others. I relax the criterion slightly to construct a second dummy, L17, which is coded 1 for communities that participate at levels 1 through 7. The variable L18 includes communities that participate at levels 1 through 8, and L19 is coded as 1 for municipalities that participate in CRS at any level.

I also use the discount that communities receive through CRS to construct a continuous dependent variable. This variable, DISC, is coded as 0 for non-participants. The amount of the discount for participants ranges from 5% for participants at Level 9 to 45% for participants at Level 1. Thus, the range of possible participation options gives several different ways that adaptive capacity can be assessed. All variables and their abbreviations can be found in Table 4.1.

Independent Variables: My primary aim is to investigate the relationship between socio-economic aggregates and CRS participation. Drawing on prior literature, I selected the following socio-economic municipal-level variables as being of particular interest:

population, poverty rates, per capita income, educational attainment, race and ethnicity (assessed as percentage of the population that consists of non-Hispanic whites), home ownership rates, occupancy rates, home values and median rents.

There is an obvious need to control for the level of flooding risk. Communities that flood more often will have more of an incentive to participate in the CRS program. To control for flooding risk, I used the following variables: Number of flood insurance claims filed, 1978-2007; total payments made to satisfy flood insurance claims; and number of flood insurance policies. In addition to the raw counts for each of these three variables, I also calculated per capita rates. This yielded a total of six variables that could be used to control for risk.

A potentially confounding variable was the form of government. It is reasonable to hypothesize that municipalities that have a city manager form of government may enjoy higher levels of professionalism than cities that are administered by elected officials. To control for this possible relationship, I created a dummy for New Jersey coastal communities to indicate the presence of a city manager form of government. I also took advantage of available data to enter three variables related to the municipal budget: the total amount in the city budget and the city's net valuation. The budgetary variables were included in an exploratory manner to investigate whether budgetary factors exert an influence on the probability of CRS participation independently of the socio-economic composition of a municipality. In each case, I hypothesized that higher levels would be associated with CRS participation. A larger city budget could allow for more staff and more specialization, and hence more professionalism. A higher net valuation could allow lower tax rates for a given level of service. Thus, there are three sets of explanatory variables used in this analysis:

socio-economic aggregates derived from Census data, indicators of physical risk derived from FEMA data, and information on the form of government for New Jersey municipalities. Each of these variables is listed in Table 4.1.

In the social sciences, it is always worth considering the problem of reverse causality, i.e., that the dependent variable may affect the independent variable and not the other way around. In the case of the CRS program, this seems unlikely. It is conceivable that reducing flood insurance rates might be beneficial to property values, and therefore might raise the socio-economic status of a participating town. However, it is unlikely that flood insurance rates determine property values to a large enough extent to measurably affect the socio-economic status of inhabitants. While the possibility of reverse causality is worth noting, it seems fairly safe to continue treating CRS participation as the dependent variable, and indicators of SES as independent.

Data Sources: Data on CRS participation is taken from the 2007 *CRS Coordinator's Handbook* (U.S. Department of Homeland Security 2007a). Data on flood losses is taken from the online FEMA report, "Loss Statistics" (U.S. Department of Homeland Security 2007b). Data on the number of flood insurance policies by municipality is taken from the FEMA report "Policy Statistics" (U.S. Department of Homeland Security 2007c).

Socio-Economic data is taken from the 2000 U.S. Census SF3 file for municipalities and county subdivisions. Municipal Gini coefficients were also calculated using SF3 income data.

The Census and the FEMA data sets were merged to create a national data set consisting of 10,916 observations. The universe for the national data set was municipalities with at least one flood insurance claim filed between 1978 and 2007. From this, a subset of 176

coastal New Jersey municipalities was selected. I used the New Jersey Municipal Data Book to add information to the New Jersey sample on form of government, and on municipal budgets (New Jersey Associates 2005).

I use the national sample of municipalities to test for associations between CRS participation and socio-economic aggregates that are measured by the U.S. Census. Tables 2 through 7 draw on the national data set. I then use the smaller New Jersey sample to test whether the presence of a city manager is a confounding variable. I also use the New Jersey sample to examine whether municipal financial capacity influences CRS participation independently of the other explanatory variables. Tables 8 through 13 show results for the New Jersey sample.

Methods: I begin with correlation matrices to assess the inter-relatedness of independent variables. Finding high levels of multicollinearity, I then follow Boruff et al. (2005) and Cutter (2003) in using principal components analysis to reduce the set of independent variables into a group of non-correlated factors that can be used for modeling purposes. However, my use of PCA differs in one key respect from these papers. The prior literature uses PCA as a data reduction technique, extracting factors that summarize a larger number of socio-economic variables. The scores for each of the factors are then summed to create an aggregate vulnerability score. This approach is unsuitable for my purposes for two main reasons. First, the theoretical basis for creating an aggregate score out of the sum of individual scores is weak. Doing so implies an assumption that all factors have equal weight in determining outcomes, an assumption that is never justified. In addition, my own interest is in using the outcomes of the PCA to predict the probability of CRS participation, rather

than to create a rating or a ranking of vulnerability across counties. Thus, there was no reason to combine the results of the PCA into aggregate scores.

Having derived factors from the PCA, the next step is to employ probit models, reporting the marginal effects of a change in each independent variable on the probability of participation. For each dependent dummy variable described above, a probit model is constructed using the following form::

$$p(P) = \alpha_{0+} \alpha_{1} X_1 + \alpha_2 X_2 + \varepsilon \qquad \text{(Equation 1)}$$

where p(P) is the probability of participation, X_1 is a matrix of variables summarizing flooding risk and X_2 is a matrix of socio-economic variables. I begin by estimating a separate probit model for each dependent variable using an indicator of risk, population, and the factors extracted from the principal components analysis as independent variables.

I then proceed to use the discount (DISC) continuous variable as a dependent variable in an OLS model. The model is similar to the probit model, except for the dependent variable:

$$DISC = \alpha\ 0 + \alpha 1X1 + \alpha 2X2 + \varepsilon \qquad \text{(Equation 2)}$$

In the OLS model, there are only ten possible values for the dependent variable, ranging from 0 to 45. In addition, there are a large number of observations coded as 0. In cases such as this, it sometimes appropriate to employ tobit models. Thus, in addition to the OLS model using DISC as a dependent variable, I use the same functional form in a tobit model.

The following steps, then, constitute the progression of quantitative reasoning in this analysis: correlation-->principal components analysis-->probit model-->OLS-->tobit. This first on the progression is performed national sample, and then repeated on the New Jersey sample.

4.3 Findings

National Sample: I begin the analysis by showing socio-economic averages by level of CRS participation. On Table 4.2, explanatory factors are listed on the left, with CRS participation levels treated as columns. It is clear from Table 4.2 that CRS participants have experienced more flooding damage than have non-participants. The LOSS variable measures the number of NFIP claims filed over the last 30 years. Non-participants registered an average of only 41 losses, compared to 607 for CRS participants. Moreover, the number of losses also increases as the CRS participation level rises from 9 (a 5% discount) to 7 (a 15% discount).

The PAYMENTS field tells a consistent story. This variable measures the total number of dollars paid in NFIP claims over the last 30 years. Non-participants averaged a total of $463,733 in NFIP claims in this period, compared to $17 million for CRS participants. The total amount of NFIP payments do not increase monotonically as CRS participation levels rise. For example, participants at Level 8 (10% discount) averaged $27 million in payments, while those at Level 7 (15%) averaged just $13 million. CRS participants also have more NFIP policies on average than do non-participants. The average non-participant has 100 policies, while the average CRS participant has over 2,000. When policies, claims and payments are normalized by population (fields LOSSPC, PAYPC and POLPC), findings do not change. Clearly, physical risk is a major explanatory variable.

There is also some indication that average SES levels are associated with CRS participation. In non-participating communities, 20% of adults have college degrees (COLL), compared to 29% of CRS participants. College graduation rates also appear to rise

as CRS participation level rises, from 25% at Level 9 to 32% at Levels 5 and 6. Per capita income (PCI) shows similar patterns.

Table 4.3 shows a correlation matrix including all dependent and explanatory variables. Boxes on the matrix delineate different categories of variables. The upper left box shows dependent variables, the middle box contains correlations between indicators of physical risk, and the box on the lower right highlights correlations between socio-economic variables.

There is a statistically significant correlation between CRS participation and indicators of risk. The variable L19 includes all CRS participants. L18 includes those that participate at Levels 1 through 8, L17 includes those that participate at Levels 1-7, and L16 includes those elite few that participate at Levels 1 through 6. The DISC variable reflects the size of the discount received by the CRS participant, another way of indicating the level of participation. Each of these variables shows a significant and positive correlation with each of the six measures of physical risk: LOSS, PAY, POL, LOSSPC, PAYPC and POLPC.

Of all the risk variables, LOSS generally has the highest correlation with CRS participation. The high association between LOSS and PAY makes these variables virtually interchangeable in a regression analysis. Thus, in the regression models presented below, LOSS serves as the indicator of risk, and the POP variable is used to control for population size.

There is also a statistically significant correlation between all of the participation variables (except L16) and all of the socio-economic variables. As expected, CRS participation is positively correlated with income, college attainment, rent and home values. There is a negative correlation between participation and dropout rates and poverty rates. There is

actually a negative correlation between participation and the percentage of non-Hispanic whites.

There are also negative correlations between participation and home ownership, as well as between participation and occupancy rates. The latter two relationships may be due to the high number of rental properties in coastal areas, regions characterized by high levels of flooding risk. Coastal properties might be vacant in April, when the Census is taken. Thus, I do not place great stock in the relationships between housing variables and participation.

The matrix shows a high correlation between socio-economic variables. Race (NHW), poverty (POV), per capita income (PCI), education variables (COLL and DROP), rents (RENT) and property values (VAL) are all highly correlated with one another. However, the correlation between socio-economic variables and risk variables is low. Thus, using all of the socio-economic variables separately as independent variables would raise the problem of multicollinearity. This suggests the need for a data reduction strategy.

Table 4.4 shows the results of a principal components analysis (PCA) undertaken in response to the problem of multicollinearity. The PCA combines nine socio-economic variables into three non-correlated factors. Together, these three factors account for 82% of the variance among the nine variables. Factor 1 in this analysis is highly correlated with income (PCI), college attainment (PCI), median rents (RENT) and median home values (VAL), negatively correlated with dropout rates (DROP) and poverty (POV). Thus, factor 1 in this analysis might be thought of as the affluence variable. Factor 2 is most strongly correlated with non-Hispanic whites (NHW); this factor is also correlated with occupancy (OCC) and home ownership rates (OWN). There is a small negative relationship between Factor 2 and income (PCI). There is also a negative relationship between Factor 2 and both

college attainment (COLL) and high school dropout rates (DROP). A city with a strong score on Factor 2 would be expected to have a large population of non-professional, moderate-income whites.

Factor 3 has a fairly strong negative correlation with non-Hispanic whites (NHW). There is also a strong correlation with occupancy rates (OCC), although occupancy is positively associated with each of the three factors. The correlation with income (PCI) is weak, as is the correlation with poverty (POV). This factor might be thought of as a proxy for minority population, controlling for income differentials between ethnic and racial groups.

If the hypothesized relationship between individual and group vulnerability is correct, then we could expect to see a strong positive association between CRS participation and Factor 1. I would expect a negative association between CRS participation and Factor 2, as this factor suggests a population with moderate income and educational attainment. I would also expect a negative association between CRS participation and Factor 3, as the latter variable indicates the presence of a large nonwhite population. Table 4.5 summarizes the independent variables used in the regression analysis, as well as the expected and observed relationships between independent variables and CRS participation.

Table 4.6a shows the results of probit models using as independent variables the factors derived from the principal components analysis. Model 1 uses participation in CRS at any level, 1-9, as the dependent variable. As expected, participation was strongly associated with the level of physical risk, as indicated by the LOSS variable. Participation was also positively associated with affluence, as measured by Factor 1. Cities with more moderate average levels of income and education, as indicated by Factor 2, were less likely to participate in CRS, as were cities with high minority populations as indicated by Factor 3.

Model 2 uses as its dependent variable participation in CRS at Levels 1-8. Results were almost identical to model 1, with significant positive coefficients for Factor 1 and significant negative coefficients for Factors 2 and 3. Model 3 uses participation at levels 1-7 as the dependent variable. Again, there was a positive coefficient for Factor 1 and negative coefficients for the other factors, all significant at a level of $p<.01$. Model 4 has results similar to the other models, except that the estimated coefficient for LOSS is no longer statistically significant. Thus, the main finding to emerge from models 1-4 is that participation is strongly associated with the factor most highly correlated with risk, and with the factor most highly correlated with affluence. CRS participation is negatively associated with the presence of a moderate-income white population, as well as with the presence of non-whites. This appears to be true regardless of the manner in which CRS participation is measured.

Three other diagnostics on Table 4.6a are worth noting. First, chi-square tests indicate that each model as a whole is statistically significant at a level of $p<.01$. Second, the McFadden's pseudo-r^2 is presented for each model. Unlike the r^2 value in OLS, McFadden's pseudo-r^2 has no natural interpretation. However, it has been suggested that the pseudo-r^2 can be used to compare the explanatory power of two models (Boorooah 2002). It can be seen that the models using L19 and L18 have higher pseudo-r^2 values than the other models. The pseudo-r^2 statistic drops slightly as the number of dependent variables coded as 1 declines.

Table 4.6a also reports the percentage of "successes" observed in the data, and the percentage predicted by the models. In Model 1, for example, 7.3% of the records were coded with a 1 in the dependent variable, while the model predicted a success rate of 5.9%. I

also experimented with different ways of slicing the data. For example, in Model 1, 73.3% of the cases with a modeled probability greater than or equal to 0.5 were in fact coded as 1. Of the 51 cases with a modeled probability between 0.4 and 0.5, 24, or 47%, were "successes" in the observed data. From the various diagnostics performed, it seems reasonable to conclude that the models have some predictive power.

Table 4.6b presents more detailed diagnostics for the four probit models. For each model, I divided the sample of cities into four groups based on the modeled probability of participation. The top panel of Table 4.6b shows diagnostics for model 1, which used CRS participation at any level as its dependent variable. The first line shows results for the group of cities with a predicted probability of participation less than 0.25. In this group, 6.2% of cities actually participated in CRS. Thus, the model accurately predicted that this group had a low probability of participation. The next line shows results for cities with an estimated probability of participation between 0.25 and 0.5. This group had an observed participation rate of .379, again within the bounds of the estimated probabilities. Similarly, the group with an estimated probability between 0.5 and 0.75 had an observed participation rate of .541 showing that on average the model accurately predicted participation for this group of cities. Finally, for cities with an estimated probability of greater than .75, the actual participation rate was about .73. This was still higher than the participation rates for other groups, although the observed participation rate was slightly below the predicted range. Overall, Model 1 seems to have done a reasonably good job of predicting participation for cities across a range of estimated probabilities.

The other models were not quite as successful, owing to small sample sizes. Still, the results for other models were somewhat encouraging. In model 2, which used participation

at Levels 1 through 8 as the dependent variable, observed probabilities increased monotonically with modeled probabilities, although observed probabilities tended to be somewhat lower than estimated probabilities. In model 3, observed probabilities increased with modeled probabilities up to the p>.75 level, where there were only two records. As shown on table 4.6a, the observed probability for the entire group was 2.2%, compared to a predicted probability of 1.5%. In the final model, virtually all cities were assigned an estimated probability of less than .25, and the observed probability was 0.008. For all cases in model 4, the observed probability was .0075, and the modeled probability was .0055. Thus, in these diagnostics, the probit models performed best for variables L19 and L18, which had more cities with predicted probabilities of greater than 0.5.

Because of the small number of successes in models 3 and 4, I generated an additional set of diagnostics for these models. In model 3, with L17 as the dependent variable, there were 80 cases with a modeled probability of 0.2 or more. Sixteen of these cases, or 20%, had an observed participation rate. By contrast, only 224 of the 10,836 cases with a modeled probability of less than 0.2 participated in the program. Thus, the model seems to have some predictive power for cases with modeled probabilities less than 0.25.

Similarly, for model 4, I discriminated between cases with a modeled probability of greater than .05 and those with modeled probabilities less than .05. Six of the 118 cases with a modeled probability greater than .05 participated in the program, an observed participation rate of 5%. By contrast, 10,798 cities had a modeled probability less than 0.05. In these, the observed probability of participation was .007. Thus, it seems reasonable to conclude that the models have some predictive power even for dependent variables with extremely low

success rates, and that the model successfully discriminates between cities with very low probabilities of participation and those with relatively higher probabilities.

Table 4.7 presents the results of an OLS model run with the same independent variables. The dependent variable in this case was the discount received by municipalities as a result of participation in CRS. The OLS results were consistent with the probit models described earlier. The size of the CRS discount was positively related to both the main risk indicator and the main affluence indicator. Discounts were negatively related to moderate income and minority populations.

Table 4.8 shows the results of the tobit model. Findings are similar to those presented for the OLS model. There are strong positive coefficients for LOSSES and Factor 1, with negative coefficients for the other two extracted socio-economic variables.

To summarize the results for the national sample: Principal components analysis was used to summarize nine explanatory socio-economic variables. One of the factors extracted was highly correlated to affluence, one to moderate income population and one to minority population. The affluence factor was strongly associated with CRS participation, while factors indicating moderate income and minority populations were negatively correlated with participation. I measured CRS participation five different ways, with little change in results. There was consistency between probit, OLS and tobit models. In the national sample, then, the relationship between CRS participation and affluence appears to be fairly robust, as is the relationship between CRS participation and flood risk.

While the main emphasis of this chapter has been to test the association between individual and group vulnerability outlined in earlier chapters, I also experimented with ways to test the hypothesized relationship between social capital and adaptive capacity. These

attempts yielded no significant results, although I was dissatisfied with all of the variables that I employed as possible proxies for social capital. First, I tried using a state-level social capital rating compiled by Putnam (2007). However, political cultures vary so widely within states that I was not satisfied with using state-level indicators to gauge social capital within cities. I also experimented with Elazar's (1984) typology of state political cultures, with similar misgivings and similar results. Finally, I attempted to employ the municipal Gini coefficient, as calculated from 2000 Census data, as an indicator of polarization. This too, though, yielded questionable results.

New Jersey Sample: As noted above, the use of a dataset representing coastal municipalities in New Jersey allowed me to incorporate some governance variables into the regression models. The additional variables included for each record in the New Jersey sample were the presence of a city manager (MGR), the net valuation of property within a municipality (NETVAL) and the size of the city budget in dollars (BUDGET).

In addition, I explored the use of some other municipal-level explanatory variables with my coastal New Jersey data set. These included the use of election returns to measure political competitiveness, membership in the Association of New Jersey Environmental Commissions to measure professionalism, and the type of municipal government (borough, city, town, township village). Although I concluded that these results were of limited use, they are presented in Appendix 4.1.

Table 4.9 shows descriptive statistics by CRS participation level for the New Jersey sample. Results are similar to the national sample. CRS participants at all levels have far more claims than do non-participants. The same is true for payments and policies. Compared to non-participating cities, communities that participate in CRS are whiter and

more highly educated. CRS communities have higher average incomes and lower poverty rates.

Table 4.10 shows a correlation matrix for the New Jersey sample. (I omitted the L16 dependent variable from the models for this sample because there were no cities in the CAFRA zone that had achieved Level 6.)

Table 4.10 shows significant correlations between each of the participation variables and each of the risk variables. As in the national sample, there are significant correlations between CRS participation and the variables related to income, poverty, education and home value. Also similar to the national sample was the high correlation between income, poverty, education and home value. There is minimal association between the risk variables and the socio-economic variables.

There is no significant correlation between the existence of a city manager form of government and CRS participation. There is also no significant correlation between any of the CRS participation variables and any of the variables related to municipal budgets.

Because of multicollinearity between the independent variables, I deemed it appropriate to use principal components analysis to summarize the explanatory variables. Table 4.11 shows the results of the principal components analysis. The PCA extracted two factors to summarize seven socio-economic variables. (In this PCA, I omitted occupancy rates, since these variables are skewed by the large number of properties devoted to seasonal rentals on the New Jersey coast.) As in the national sample, the PCA extracted one factor with strong positive correlations to college attainment, ownership rates, median rents and home values; the factor had strong negative correlations with high school dropout rates and poverty. The second factor differed from the first primarily in high negative correlations with the

percentage of non-Hispanic whites and in poverty rates. Thus, the PCA extracted two factors that I proceeded to use in probit, OLS and tobit models. Together, these factors explained 84% of the variance in the seven variables.

Table 4.12 shows a summary of the independent variables used in regression analysis for the New Jersey sample. Factors 1 and 2 are derived from the PCA. MGR is a dummy variable indicating the presence of a city manager form of government. BUDGET indicates the size of each city's municipal budget in dollars. NETVAL is the total net valuation of property in each municipality.

Table 4.13a shows the results of the probit models. First, I used CRS participation at Level 7 as my dependent variable. Model 1 showed a positive coefficient for the affluence variable and a negative coefficient for the race-related factor, although neither was significant at $p<.05$. Risk, as indicated by the LOSS variable, is positive and significant, as expected. In model 2, I add the presence of a city manager form of government as an explanatory variable. Loss continues to be significant, but form of government did not show a significant coefficient. In models 3 and 4, I added budgetary variables, neither of which showed a significant coefficient. Model 3 adds net valuation, and model 4 adds the amount of the city budget.

The middle panel in Table 4.13 shows the results of probit models using CRS participation at Level 7 or Level 8 as the dependent variable. Results were somewhat more significant than those described above. Model 1 shows a significant positive association between affluence and participation, though the race factor is not significant at $p<.05$. The explanatory variables added in models 2 through 5 are not significant at $p<.05$, and they do not change the signs or the significance of the other variables.

The bottom panel on Table 4.13 uses CRS participation at any level as the dependent variable. Results resembled the other panels. Model 1 produced positive and significant coefficients for risk and affluence. Models 2 through 4 produced no significant coefficients for the city manager variable, the net valuation variable or the city budget variable.

Diagnostics for the probit models are shown in table 4.13b. For L19, all observed probabilities were in the same range as the modeled probabilities. For L18, the same is true except for the range with the highest estimated probability, which had only one case. For L17, the cities with a modeled probability of less than 0.25 had an observed participation rate of .03, within the predicted range. For cities with a modeled probability of .25 to .5, 29% were participants, also within the predicted range. Thus, it appears that the probit models have some predictive ability.

Table 4.14 shows the results of OLS models estimated using "Discount" as the dependent variable. Model 1 again shows positive and significant coefficients for the risk and affluence variables. Models 2 through 5, as above, show no significant coefficients for the city manager variable or for the budgetary variables. No other variables are significant except for Factor 2 in model 3, which may be a spurious relationship.

In the New Jersey sample, possible values for the Discount variable were constricted to zero, for non-participants, 5 for Level 9 participants, 10 for Level 8 participants, and 15 for Level 7 participants. Thus, the dependent variable in the New Jersey sample was even more constricted than in the national OLS model presented above. For this reason, I thought it possible that a tobit model was more appropriate than an OLS model for investigating the Discount variable.

Table 4.15 shows the results of tobit models. Results are similar to those presented for the OLS model above. Risk and Affluence consistently have significant and positive coefficients. Factor 2 is not significant in any model. City manager and budgetary variables do not add to the predictive power of the models.

Results for the New Jersey sample, then, are generally consistent with results for the national sample. Factors highly correlated with risk and affluence are seen as statistically significant predictors of CRS participation. The relationship shows up regardless of how the dependent variable is measured. The probit model showed similar results for all three levels of CRS participation analyzed. The OLS model and the tobit model showed virtually identical results using the CRS discount as the dependent variable.

Most notably, the results were not affected by the form of government observed, nor did budgetary variables appear to exert an independent effect on the probability of CRS participation. Thus, the relationship between SES and adaptive capacity remains even after controlling for differences in the financial capacity of municipalities.

I also attempted to include measures of social capital in the New Jersey sample, although I was dissatisfied with the validity of the proxies employed. None showed any significant relationships. Explanatory variables added included membership in the Association of New Jersey Environmental Commissions (ANJEC) and voter turnout rates. As in the national sample, my inability to find a valid quantitative indicator of social capital for New Jersey municipalities points to a need for additional investigation using qualitative methods.

4.4 Conclusion

This chapter contributes to literature on adaptive capacity in two ways. First, I tested assumptions about the association between individual and group vulnerability at the municipal level. The evidence suggests that indicators of individuals' socio-economic status, when aggregated to the group level, have some power to predict the probability that an adaptive behavior will be adopted at the community level. The models presented in this chapter controlled for flooding risk, and explored potential confounding factors such as governmental form. Second, the study used a very specific adaptation as a proxy for adaptive capacity, in contrast to most prior quantitative research on the phenomenon.

Analyses such as these raise as many questions as they answer. First, the results presented here apply to only one specific type of adaptation. It would be useful to test associations between socio-economic status and other types of adaptive behavior at the community level.

More fundamentally, this type of analysis cannot elucidate the reasons behind the association between SES and adaptive capacity. The causal mechanism between the SES of individuals and the effectiveness of a local government's floodplain management is not obvious.

This kind of causal thread is difficult to establish by means of quantitative analysis. Thus, the evidence presented in this chapter raises a need to investigate causal processes in greater depth through case studies. Needed is a rich description of the practices involved in floodplain management, set in the context of a community's governance. The remainder of this dissertation is devoted to this task.

Table 4.1 Names and Abbreviations of Variables

Variable Name	Definition
Dependent Variables:	
L19	Dummy indicating participation in CRS at any level between 1 and 9
L18	Dummy indicating participation in CRS at any level between 1 and 8
L17	Dummy indicating participation in CRS at any level between 1 and 7
L16	Dummy indicating participation in CRS at any level between 1 and 6
Indicators of Physical Risk	
DISC	Amount of Discount on flood insurance rates due to participation in CRS
LOSS	Number of Flood Insurance Claims, 1978-2007
LOSSPC	Number of Flood Insurance Losses, per capita
PAY	Amount paid to Flood Insurance claimants
PAYPC	Amount paid to Flood Insurance claimants, per capita
POL	Number of Flood Insurance Policies
POLPC	Number of Flood Insurance policies, per capita
Socio-Economic Variables	
BUDGET	Municipal Budget
COLL	College graduates, as percent of population age 25 and over
DROP	Percent of population age 25 and higher that did not complete high school
GINI	Gini coefficient
RENT	Median rent
VAL	Median value, single family home
MGR	Dummy indicating city manager form of government
NETVAL	Net valuation
NHW	Non-Hispanic Whites, as percent of population
OCC	Housing unit occupancy rate
OWN	Owner occupied units as a percent of total occupied units
PCI	Per Capita Income
POP	Population
POV	Individual Poverty Rate

Table 4.2: Socio-Economic Averages by CRS Participation Level, National Sample

	Non-Participant	Level 10 (Rescinded)	Level 9	Level 8	Level 7	Level 6	Level 5	Level 4	Level 2	Level 1	Level 1-9	Level 1-8	Level 1-7	Level 1-6	Level 1-5
N	10,489	91	219	340	158	58	21	1	1	1	799	580	240	82	24
LOSS	41	443	289	729	802	454	880	41	2,513	292	607	728	726	581	888
PAY (million)	0.5	7	5	27.7	13.4	9.4	23.6	0.4	38.1	9.9	17.2	21.7	13.3	13.3	22.7
POL	100	843	912	1,718	4,607	3,135	2,234	432	1,701	357	2,181	2,661	3,996	2,820	2,059
POP	12,639	39,132	27,429	41,941	111,260	96,058	46,844	118,440	393,051	80,092	56,311	67,217	103,024	87,155	65,638
NHW	0.851	0.788	0.790	0.767	0.770	0.744	0.751	0.854	0.672	0.796	0.772	0.765	0.762	0.747	0.754
DROP	0.186	0.164	0.167	0.145	0.133	0.126	0.126	0.057	0.147	0.084	0.147	0.139	0.130	0.125	0.122
COLL	0.204	0.264	0.248	0.291	0.311	0.322	0.321	0.484	0.283	0.314	0.286	0.301	0.315	0.323	0.326
PCI	20,549	23,942	22,005	26,098	27,424	28,370	27,758	22,133	21,534	27,021	25,437	26,733	27,633	28,037	27,234
POV	0.118	0.106	0.126	0.115	0.103	0.102	0.095	0.141	0.141	0.050	0.114	0.110	0.102	0.101	0.097
OCC	0.893	0.893	0.882	0.849	0.812	0.820	0.871	0.959	0.924	0.964	0.850	0.837	0.821	0.838	0.881
OWN	0.643	0.624	0.597	0.555	0.525	0.541	0.597	0.548	0.513	0.669	0.561	0.547	0.536	0.557	0.595
RENT	442	563	498	585	648	657	641	643	437	716	580	611	649	651	636
VAL	109,642	140,742	118,229	162,029	171,766	172,371	176,757	164,000	81,900	192,300	153,027	166,167	172,028	172,532	172,921
LOSSPC	0.014	0.082	0.031	0.064	0.092	0.131	0.128	0.000	0.006	0.004	0.067	0.080	0.104	0.126	0.113
PAYPC	160	829	508	882	917	2,049	2,971	3	97	124	923	1,080	1,360	2,213	2,609
POLPC	0.023	0.090	0.076	0.173	0.231	0.255	0.170	0.004	0.004	0.005	0.163	0.196	0.229	0.224	0.149
GINI	0.409	0.425	0.426	0.435	0.439	0.434	0.427	0.426	0.476	0.390	0.433	0.436	0.437	0.432	0.428

Table 4.3: Correlation Matrix, National Sample

	L16	L17	L18	L19	DISC	LOSS	PAY	POL	LOSSPC	PAYPC	POLPC	POP	NHW	DROP	COLL	PCI	POV	OCC	OWN	RENT	VAL	GINI
L16	1.000	0.580	0.367	0.310	0.583	0.034	0.015	0.107	0.078	0.104	0.065	0.060	-0.042	-0.052	0.066	0.057	-0.017	-0.038	-0.047	0.075	0.050	0.031
L17	0.580	1.000	0.633	0.534	0.787	0.077	0.025	0.269	0.106	0.103	0.115	0.126	-0.061	-0.082	0.106	0.092	-0.028	-0.086	-0.102	0.128	0.085	0.065
L18	0.367	0.633	1.000	0.843	0.919	0.121	0.069	0.273	0.122	0.122	0.152	0.116	-0.094	-0.107	0.144	0.125	-0.021	-0.104	-0.144	0.162	0.120	0.097
L19	0.310	0.534	0.843	1.000	0.894	0.117	0.063	0.259	0.113	0.118	0.143	0.108	-0.101	-0.105	0.142	0.114	-0.011	-0.094	-0.145	0.153	0.106	0.104
DISC	0.583	0.787	0.919	0.894	1.000	0.117	0.059	0.284	0.128	0.135	0.150	0.127	-0.097	-0.110	0.147	0.123	-0.022	-0.101	-0.142	0.164	0.115	0.098
LOSS	0.034	0.077	0.121	0.117	0.117	1.000	0.958	0.301	0.083	0.157	0.039	0.249	-0.063	0.001	0.021	0.011	0.023	-0.021	-0.052	0.022	0.012	0.049
PAY	0.015	0.025	0.069	0.063	0.059	0.958	1.000	0.104	0.038	0.135	0.011	0.078	-0.038	0.004	0.007	0.000	0.020	-0.006	-0.025	0.002	0.000	0.029
POL	0.107	0.269	0.273	0.259	0.284	0.301	0.104	1.000	0.042	0.057	0.119	0.328	-0.114	-0.011	0.043	0.038	0.015	-0.041	-0.084	0.072	0.027	0.073
LOSSPC	0.078	0.106	0.122	0.113	0.128	0.083	0.038	0.042	1.000	0.804	0.384	-0.018	0.055	0.001	0.014	0.048	-0.023	-0.289	-0.147	-0.003	0.044	0.003
PAYPC	0.104	0.103	0.122	0.118	0.135	0.157	0.135	0.057	0.804	1.000	0.314	-0.011	0.034	-0.004	0.013	0.035	-0.015	-0.227	-0.120	0.000	0.031	0.021
POLPC	0.065	0.115	0.152	0.143	0.150	0.039	0.011	0.119	0.384	0.314	1.000	-0.012	0.032	-0.062	0.066	0.128	-0.040	-0.320	-0.177	0.038	0.131	0.001
POP	0.060	0.126	0.116	0.108	0.127	0.249	0.078	0.328	-0.018	-0.011	-0.012	1.000	-0.158	-0.002	0.054	0.014	0.034	0.055	-0.080	0.076	0.040	0.067
NHW	-0.042	-0.061	-0.094	-0.101	-0.097	-0.063	-0.038	-0.114	0.055	0.034	0.032	-0.158	1.000	-0.412	0.092	0.165	-0.500	-0.096	0.275	-0.017	0.042	-0.288
DROP	-0.052	-0.082	-0.107	-0.105	-0.110	0.001	0.004	-0.011	0.001	-0.004	-0.062	-0.002	-0.412	1.000	-0.710	-0.595	0.704	-0.068	-0.300	-0.556	-0.508	0.241
COLL	0.066	0.106	0.144	0.142	0.147	0.021	0.007	0.043	0.014	0.013	0.066	0.054	0.092	-0.710	1.000	0.795	-0.440	0.081	0.169	0.711	0.748	0.144
PCI	0.057	0.092	0.125	0.114	0.123	0.011	0.000	0.038	0.048	0.035	0.128	0.014	0.165	-0.595	0.795	1.000	-0.510	0.030	0.268	0.728	0.870	0.126
POV	-0.017	-0.028	-0.021	-0.011	-0.022	0.023	0.020	0.015	-0.023	-0.015	-0.040	0.034	-0.500	0.704	-0.440	-0.510	1.000	-0.116	-0.474	-0.503	-0.411	0.506
OCC	-0.038	-0.086	-0.104	-0.094	-0.101	-0.021	-0.006	-0.041	-0.289	-0.227	-0.320	0.055	-0.096	-0.068	0.081	0.030	-0.116	1.000	0.560	0.151	0.031	-0.144
OWN	-0.047	-0.102	-0.144	-0.145	-0.142	-0.052	-0.025	-0.084	-0.147	-0.120	-0.177	-0.080	0.275	-0.300	0.169	0.268	-0.474	0.560	1.000	0.211	0.173	-0.388
RENT	0.075	0.128	0.162	0.153	0.164	0.022	0.002	0.072	-0.003	0.000	0.038	0.076	-0.017	-0.556	0.711	0.728	-0.503	0.151	0.211	1.000	0.767	-0.063
VAL	0.050	0.085	0.120	0.106	0.115	0.012	0.000	0.027	0.044	0.031	0.131	0.040	0.042	-0.508	0.748	0.870	-0.411	0.031	0.173	0.767	1.000	0.081
GINI	0.031	0.065	0.097	0.104	0.098	0.049	0.029	0.073	0.003	0.021	0.001	0.067	-0.288	0.241	0.144	0.126	0.506	-0.144	-0.388	-0.063	0.081	1.000

Values greater than 0.020 are significant at $p<.05$

Table 4.4a Principal Component Analysis

Com-ponent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	4.431	49.232	49.232	4.431	49.232	49.232	3.819	42.438	42.438
2	1.610	17.888	67.119	1.610	17.888	67.119	1.933	21.478	63.916
3	1.319	14.657	81.776	1.319	14.657	81.776	1.607	17.860	81.776
4	.481	5.342	87.118						
5	.405	4.498	91.616						
6	.309	3.435	95.050						
7	.198	2.205	97.255						
8	.144	1.602	98.857						
9	.103	1.143	100.000						

Table 4.4b Component Matrix, National Sample

	Component		
	1	**2**	**3**
NHW	.308	.527	-.683
DROP	-.819	-.130	.264
COLL	.857	-.276	.058
PCI	.888	-.243	.035
POV	-.741	-.391	.276
OCC	.175	.544	.735
OWN	.432	.729	.315
MEDRENT	.826	-.257	.216
MEDVAL	.834	-.364	.128

Extraction Method: Principal Component Analysis.

3 components extracted.

Table 4.5 Summary of Variables and Expected Relationships in Regression Models, National Sample			
Independent Variable	Description	Expected Relationship to CRS Participation	Observed Relationship
FACTOR 1	Highly correlated with income and education, strong negative correlation with poverty; high values indicate presence of affluent population.	Positive	Positive and Significant
FACTOR 2	Highly correlated with percentage of non-Hispanic whites, otherwise fairly weak correlations; high values indicate presence of working class white population.	Negative	Negative and Significant
FACTOR 3	Highly correlated with minority population, weak correlation with other variables; high values indicate presence of minority population.	Negative	Negative and Significant

Table 4.6a Probit Models, National Sample

Dependent Variable

	l19	l18	l17	l16
POP	-9.76E-08 **	-4.12E-08 **	2.17E-08 **	4.95E-09 *
LOSS	0.00008 **	0.00005 **	7.73E-07 *	1.92E-07
FAC1_1	0.02817 **	0.02231 **	0.00933 **	0.00315 **
FAC2_1	-0.01550 **	-0.01145 **	-0.00399 **	-0.00151 *
FAC3_1	-0.01830 **	-0.01466 **	-0.00709 **	-0.00188 **
Obs p	0.07320	0.05313	0.02199	0.00751
Pred p	0.05936	0.03937	0.01549	0.00551
Pseudo r^2	0.12810	0.14560	0.11490	0.07920

Table 4.6b Probit Diagnostics, National Sample

Variable	Modeled Probability	Non-Participants	Participants	Observed Probability
L19	0-.25	9938	652	0.062
L19	.25-.5	136	83	0.379
L19	.5-.75	34	40	0.541
L19	.75-1	9	24	0.727
L18	0-.25	10192	486	0.046
L18	.25-.5	111	62	0.358
L18	.5-.75	25	22	0.468
L18	.75-1	8	10	0.556
L17	0-.25	10639	235	0.022
L17	.25-.5	31	1	0.031
L17	.5-.75	4	4	0.500
L17	.75-1	2	0	0.000
L16	0-.25	10831	82	0.008
L16	.25-.5	2	0	0.000
L16	.5-.75	0	0	
L16	.75-1	1	0	0.000

Table 4.7 OLS Model

National Sample	
POP	2.67E-06 **
LOSS	0.0002089 **
FAC1_1	0.5461351 **
FAC2_1	-0.154617 **
FAC3_1	-0.426078 **
CONST	0.0295086 **
R^2	0.074
Obs	10916

Table 4.8 Tobit Model

National Sample	
pop	0.0000106 **
losses	0.0006907 **
FAC1_1	4.915251 **
FAC2_1	-2.636587 **
FAC3_1	-3.562008 **
CONST	-31.00729 **
Pseudo r^2	0.049
Obs	10916

Table 4.9 Socio-Economic Variables by CRS Participation Level, New Jersey Sample

	Non-Participant	Level 10 (Rescinded)	Level 9	Level 8	Level 7	Level 7-8	Level 7-9
N	131	14	4	17	10	27	31
CLAIMS	138	516	1,223	461	1,061	683	752
PAY	206	3,219	276	1,452	2,394	1,801	1,604
POL	543	1,436	2,975	1,697	3,932	2,525	2,583
POP	18,001	16,097	38,995	7,875	6,046	7,198	11,301
NHW	0.740	0.889	0.750	0.874	0.924	0.892	0.874
DROP	185.687	178.286	193.250	127.824	112.200	122.037	131.226
COLL	254.893	211.071	194.250	316.176	342.600	325.963	308.968
PCI	25,730	24,768	22,239	32,711	40,840	35,722	33,982
POV	0.088	0.063	0.101	0.057	0.057	0.057	0.063
OWN	0.672	0.742	0.692	0.742	0.771	0.752	0.745
MEDRENT	775	784	761	812	878	836	827
MEDVAL	168,642	155,171	125,575	272,476	289,000	278,596	258,852
LOSSPC	0.021	0.390	0.039	0.209	0.348	0.261	0.232
PAYPC	206	3,219	276	1,452	2,394	1,801	1,604
POLPC	0.065	0.409	0.130	0.855	1.246	1.000	0.888
MGR	0.756	0.643	0.750	0.647	0.800	0.704	0.710
BUDG	9,727,117	7,209,389	46,008,500	9,333,309	8,327,443	8,960,766	13,741,119
TAXRATE	3,341	2,827	3,120	1,756	1,784	1,766	1,941

Table 4.10 Correlation Matrix, New Jersey Sample

	L19	L18	L17	DISC	LOSS	PAY	POL	LOSSPC	POLPC	PAYPC	POP
L19	1.000	0.577 **	0.531 **	0.730 **	0.362 **	0.299 **	0.369 **	0.202 **	0.479 **	0.159 *	-0.093
L18	0.577 **	1.000	0.921 **	0.962 **	0.325 **	0.269 **	0.335 **	0.232 **	0.628 **	0.180 *	-0.144
L17	0.531 **	0.921 **	1.000	0.952 **	0.414 **	0.312 **	0.378 **	0.211 **	0.582 **	0.161 *	-0.088
DISC	0.730 **	0.962 **	0.952 **	1.000	0.408 **	0.325 **	0.399 **	0.240 **	0.637 **	0.186 *	-0.122
LOSS	0.362 **	0.325 **	0.414 **	0.408 **	1.000	0.886 **	0.844 **	0.424 **	0.490 **	0.393 **	0.014
PAY	0.299 **	0.269 **	0.312 **	0.325 **	0.886 **	1.000	0.694 **	0.443 **	0.422 **	0.449 **	-0.010
POL	0.369 **	0.335 **	0.378 **	0.399 **	0.844 **	0.694 **	1.000	0.184 *	0.477 **	0.136	-0.004
LOSSPC	0.202 **	0.232 **	0.211 **	0.240 **	0.424 **	0.443 **	0.184 *	1.000	0.554 **	0.991 **	-0.132
POLPC	0.479 **	0.628 **	0.582 **	0.637 **	0.490 **	0.422 **	0.477 **	0.554 **	1.000	0.476 **	-0.206 **
PAYPC	0.159 *	0.180 *	0.161 *	0.186 *	0.393 **	0.449 **	0.136	0.991 **	0.476 **	1.000	-0.126
POP	-0.093	-0.144	-0.088	-0.122	0.014	-0.010	-0.004	-0.132	-0.206 **	-0.126	1.000
NHW	0.170 *	0.232 **	0.213 **	0.232 **	0.117	0.079	0.119	0.190 *	0.312 **	0.170 *	-0.489 **
DROP	-0.159 *	-0.234 **	-0.210 **	-0.229 **	-0.018	-0.004	-0.058	-0.016	-0.236 **	0.000	0.330 **
COLL	0.135	0.187 *	0.150 *	0.177 *	-0.032	-0.014	0.054	0.009	0.224 **	0.003	-0.141
PCI	0.279 **	0.303 **	0.263 **	0.312 **	0.034	0.064	0.072	0.104	0.328 **	0.105	-0.204 **
POV	-0.100	-0.176 *	-0.147	-0.162 *	0.055	0.021	0.048	-0.067	-0.121	-0.066	0.323 **
OWN	0.106	0.142	0.135	0.145	-0.007	-0.001	-0.066	0.105	0.169 *	0.097	-0.335 **
RENT	0.129	0.125	0.110	0.133	-0.112	-0.070	-0.075	0.001	0.028	0.024	-0.094
VAL	0.236 **	0.370 **	0.318 **	0.352 **	0.046	0.066	0.118	0.122	0.423 **	0.108	-0.150 *
MGR	0.034	-0.034	-0.030	-0.018	0.010	0.000	0.065	-0.185 *	-0.143	-0.179 *	0.242 **
BUDGET	-0.028	-0.032	0.096	0.021	0.294 **	0.220 **	0.272 **	-0.079	-0.084	-0.085	0.755 **
NETVAL	0.080	0.058	0.165 *	0.116	0.437 **	0.318 **	0.446 **	0.004	0.123	-0.021	0.697 **

	NHW	DROP	COLL	PCI	POV	OWN	RENT	VAL	MGR	BUDGET	NETVAL
L19	0.170 *	-0.159 *	0.135	0.279 **	-0.100	0.106	0.129	0.236 **	0.034	-0.028	0.080
L18	0.232 **	-0.234 **	0.187 *	0.303 **	-0.176 *	0.142	0.125	0.370 **	-0.034	-0.032	0.058
L17	0.213 **	-0.210 **	0.150 *	0.263 **	-0.147	0.135	0.110	0.318 **	-0.030	0.096	0.165 *
DISC	0.232 **	-0.229 **	0.177 *	0.312 **	-0.162 *	0.145	0.133	0.352 **	-0.018	0.021	0.116
LOSS	0.117	-0.018	-0.032	0.034	0.055	-0.007	-0.112	0.046	0.010	0.294 **	0.437 **
PAY	0.079	-0.004	-0.014	0.064	0.021	-0.001	-0.070	0.066	0.000	0.220 **	0.318 **
POL	0.119	-0.058	0.054	0.072	0.048	-0.066	-0.075	0.118	0.065	0.272 **	0.446 **
LOSSPC	0.190 *	-0.016	0.009	0.104	-0.067	0.105	0.001	0.122	-0.185 *	-0.079	0.004
POLPC	0.312 **	-0.236 **	0.224 **	0.328 **	-0.121	0.169 *	0.028	0.423 **	-0.143	-0.084	0.123
PAYPC	0.170 *	0.000	0.003	0.105	-0.066	0.097	0.024	0.108	-0.179 *	-0.085	-0.021
POP	-0.489 **	0.330 **	-0.141	-0.204 **	0.323 **	-0.335 **	-0.094	-0.150 *	0.242 **	0.755 **	0.697 **
NHW	1.000	-0.692 **	0.315 **	0.405 **	-0.698 **	0.700 **	0.261 **	0.305 **	-0.175 *	-0.480 **	-0.190 *
DROP	-0.692 **	1.000	-0.766 **	-0.686 **	0.775 **	-0.510 **	-0.549 **	-0.594 **	0.022	0.281 **	-0.006
COLL	0.315 **	-0.766 **	1.000	0.819 **	-0.507 **	0.172 *	0.656 **	0.792 **	0.030	-0.078	0.113
PCI	0.405 **	-0.686 **	0.819 **	1.000	-0.507 **	0.298 **	0.773 **	0.885 **	-0.031	-0.130	0.089
POV	-0.698 **	0.775 **	-0.507 **	-0.507 **	1.000	-0.676 **	-0.459 **	-0.386 **	0.075	0.300 **	0.066
OWN	0.700 **	-0.510 **	0.172 *	0.298 **	-0.676 **	1.000	0.254 **	0.149 *	-0.163 *	-0.390 **	-0.141
RENT	0.261 **	-0.549 **	0.656 **	0.773 **	-0.459 **	0.254 **	1.000	0.685 **	0.029	-0.076	0.031
VAL	0.305 **	-0.594 **	0.792 **	0.885 **	-0.386 **	0.149 *	0.685 **	1.000	0.007	-0.062	0.134
MGR	-0.175 *	0.022	0.030	-0.031	0.075	-0.163 *	0.029	0.007	1.000	0.218 **	0.244 **
BUDGET	-0.480 **	0.281 **	-0.078	-0.130	0.300 **	-0.390 **	-0.076	-0.062	0.218 **	1.000	0.757 **
NETVAL	-0.190 *	-0.006	0.113	0.089	0.066	-0.141	0.031	0.134	0.244 **	0.757 **	1.000

** Significant at p<.01

* Significant at p<.05

Table 4.11a Principal Component Analysis, New Jersey Sample

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.629	66.125	66.125	4.629	66.125	66.125
2	1.242	17.736	83.862	1.242	17.736	83.862
3	.402	5.737	89.598			
4	.349	4.984	94.582			
5	.199	2.838	97.419			
6	.095	1.354	98.773			
7	.086	1.227	100.000			
Extraction Method: Principal Component Analysis.						

Table 4.11b Component Matrix, New Jersey Sample

	Component	
	1	2
PCI	.909	.288
POV	-.746	.523
DROP	-.888	.294
COLL	.874	.253
MEDRENT	.782	.331
MEDVAL	.837	.396
NHW	.617	-.684
Extraction Method: Principal Component Analysis.		
a. 2 components extracted.		

Table 4.12 Summary of Variables and Expected Relationships in Regression Models, New Jersey			
Independent Variable	Description	Expected Relationship to CRS Participation	Observed Relationship
FACTOR 1	Highly correlated with income and education, strong negative correlation with poverty; high values indicate presence of affluent population.	Positive	Positive and Significant
FACTOR 2	Highly correlated with percentage of non-Hispanic whites, otherwise fairly weak correlations; high values indicate presence of working class white population.	Negative	Negative but not significant at $p<.05$
MGR	Dummy indicating presence of city manager form of government	Positive	No significant relationship
BUDGET	Size of city budget, dollar amount	Positive	No significant relationship
NETVAL	City's total net valuation	Positive	No significant relationship

Table 4.13a Probit Models, New Jersey Sample

Dependent Variable: CRS Participation at Level 7

	Model 1	Model 2	Model 3	Model 4
POP	-2.60E-05	-3.20E-05	-1.30E-05	-2.00E-05
LOSS	0.000921 **	0.000914 **	0.001178 **	0.000974 **
FAC1_1	0.46958	0.460999	0.557727	0.44337
FAC2_1	-0.08299	-0.08991	-0.0809	-0.04125
MGR		0.3144		-9.14E-09
NETVAL			-1.96E-10	
BUDG				-2.00306
Obs P	0.0568	0.0568	0.0568	0.0568
Pred P	0.0143	0.0128	0.0142	0.0154
Pseudo r^2	0.3221	0.3286	0.3355	0.3236

Dependent Variable: CRS Participation at Level 7 or 8

	Model 1	Model 2	Model 3	Model 4
POP	-1.60E-05	-1.60E-05	-1.10E-05	-2.10E-05
LOSS	0.000786 **	0.000787 **	0.000898 **	0.000708 **
FAC1_1	0.469985 **	0.470651 **	0.498086 **	0.515352 **
FAC2_1	-0.07888	-0.07839	-0.06708	-0.14751
MGR		-0.02757		
NETVAL			-8.86E-11	
BUDG				9.62E-09
Obs P	0.1534	0.1534	0.1534	0.1534
Pred P	0.0961	0.096	0.0977	0.0905
Pseudo r^2	0.2256	0.2257	0.2275	0.2293

Dependent Variable: CRS Participation at Any Level

	Model 1	Model 2	Model 3	Model 4
POP	-4.05E-06	-3.22E-06	-3.11E-06	-1.80E-05
LOSS	0.000934 **	0.000937 **	0.000958 **	0.000741 **
FAC1_1	0.449357 **	0.451717 **	0.454815 **	0.560647 **
FAC2_1	-0.08739	-0.08469	-0.08487	-0.26052
MGR		-0.11579		
NETVAL			-1.82E-11	
BUDG				3.08E-08
Obs P	0.1761	0.1761	0.1761	0.1761
Pred P	0.1268	0.1262	0.127	0.1139
Pseudo r^2	0.2249	0.2259	0.225	0.2474

Table 4.13b Probit Diagnostics, New Jersey Sample

Variable	Modeled Probability	Participants	Non-Participants	Observed Probability
L17	0-.25	6	160	0.036145
L17	.25-.5	2	5	0.285714
L17	.5-.75	2	0	1
L17	.75-1	0	1	0
L18	0-.25	9	132	0.06383
L18	.25-.5	13	14	0.481481
L18	.5-.75	5	2	0.714286
L18	.75-1	0	1	0
L19	0-.25	12	128	0.085714
L19	.25-.5	12	13	0.48
L19	.5-.75	5	3	0.625
L19	.75-1	2	1	0.666667

Table 4.14 OLS Models, New Jersey Sample

	Model 1	Model 2	Model 3	Model 4
POP	-1.1E-05	-1.1E-05	-8.57E-06	5.10E-06
LOSS	0.003404 **	0.003404 **	0.003456 **	0.003872 **
Fac1_1	1.153035 **	1.153657 **	1.150156 **	1.303282 **
Fac2_1	0.235468	0.236726	0.250446	0.231831
MGR	1.172862	-0.04344		
BUDG			-5.58E-09	
NETVAL				-3.84E-10
Const	1.1729 **	1.202245 *	1.176944 **	1.219722 **
R^2	0.2511	0.2511	0.2512	0.234

Table 4.15 Tobit Models

	Model 1	Model 2	Model 3	Model 4
Pop	-0.00013	-0.00012	-0.00023	-7.3E-05
Losses	0.018695 **	0.018755 **	0.016527 **	0.020182 **
Fac1_1	9.380759 **	9.412351 **	11.04211 **	9.644165 **
Fac2_1	-1.95709	-1.91732	-4.22645	-1.72108
MGR		-1.47336		
BUDG			2.28E-07	
NETVAL				-1.15E-09
Const	-25.1429 **	-24.28 **	-26.1211 **	-25.073 **
Pseudo r^2	0.1333	0.1336	0.1372	0.1338

Chapter 5: Theoretical Framework

Chapter 2 argued that current literature on adaptive capacity has two main weaknesses. First, prior literature assumes a relationship between individual and group vulnerability, but the causal link is never clearly explained. For example, there is a common assumption that communities with lower education levels will exhibit less adaptive capacity. But the theoretical linkage between the average education level of individuals and the capacity of community elites is not specified. There is a need for theoretical clarity on the relationship between average socio-economic traits and adaptive capacity at the community level.

Second, the assumed relationships between individual and group vulnerability have not been empirically tested at the community level. The previous chapter provided a test of the assumed relationship at the community level, and supported the hypothesis found in prior literature.

In this chapter, I draw on the social capital theory of Robert Putnam (1993) and the regime analysis of Clarence Stone (2005) to outline a theoretical explanation of the relationship between SES and adaptive capacity. The central thesis in this section is that a high level of adaptive capacity at the community level is aided by a stable and broad-based governing coalition.

5.1 Social Capital

Putnam's version of social capital borrows a little bit from two very different French social theorists. First, de Tocqueville (2001) clearly influences Putnam's emphasis on civic engagement as a prerequisite for a well-functioning democratic society. Second, Pierre

Bourdieu (1977), who actually coined the term social capital, contributes the notion that social networks form a type of resource that can be used to leverage other types of resources, both political and economic.

Putnam put his own spin on social capital in two influential books. *Making Democracy Work* (1993) is a study of regional governments in Italy. In this book, he presents compelling, if sometimes disputed, evidence that networks of trust in communities influence the effectiveness of governments in those communities. Taking a long historical view, he shows how political culture in northern and southern Italy evolved over the course of several centuries. Southern Italy, conquered by the oppressive Normans in the Middle Ages, was stunted in the development of its civic culture. With surplus production ruthlessly expropriated by their overlords, communities in southern Italy struggled to gain the resources needed to maintain a secure existence. In response to this state of scarcity, the extended family became the basic institution of society. Loyalty within the family was strictly enforced, while suspicion of outsiders was cultivated. By contrast, communities in Northern Italy were left alone by the major powers, allowing them a creative anarchy in which communities could work together to achieve commercial success. Putnam asserts that the presence of trusting relationships in northern communities, and their dearth in southern communities, influenced the effectiveness of democratic governance in late 20th Century Italy.

In *Bowling Alone* (2000), Putnam refines his own idea of social capital by adopting the distinction proposed by Gittell and Vidal (1998) between bonding social capital and bridging social capital. Bonding social capital may be defined as a very tight and intense bond between individuals, an example of which might be the family ties that Putnam observed in

southern Italy. These close-knit relationships do constitute a resource, and hence may be seen as a form of social capital.

A second type of social capital is known as bridging. This type of social capital consists of the ability of groups to form mutually beneficial ties to outside groups. Bonding social capital can have a downside if it interferes with the formation of bridging social capital. Putnam finds this formulation an improvement over the distinction between strong and weak ties proposed by Grannovetter (1973).

Woolcock (2001) refines Putnam's formulation by adding a third type of social capital, known as linking social capital. As I understand the term, linking social capital seems to be a specialized form of bridging social capital. Linking refers to the ability of groups to form asymmetrical relationships with entities possessing more power or resources. For example, the ability of individuals and groups to access the resources of a local government might be an example of linking social capital. Linking social capital includes an ability to have respectful dialogues with persons from different groups.

Szreter (2002) presents a thorough reworking of the concept of social capital, offering a description of the complex interaction between politics, economics and social capital. At the community level, linking social capital can only occur when citizens value the services provided by the local government. When government services are valued by citizens, political entrepreneurs will compete to take credit for service delivery. A vigorous and competitive political environment will be the result, with winning candidates continually striving to deliver services effectively and efficiently.

In such an environment, local government is properly seen as a part of civil society, rather than an entity apart:

> The notion that there is an absolute distinction between 'the state' and 'civil society' is a chimera perpetrated by the individualist free market analysis of the New Right. In well functioning liberal democracies characterized by an optimal balance of bonding, bridging and linking social capital, the two go hand in hand and are mutually beneficial in their functioning. (602).

In such an environment, Szreter theorizes, responsive governance and civic engagement are two sides of the same coin. Citizens' endorsement of the collective enterprise of the state, at both national and local levels, feeds the engagement that promotes bridging and linking social capital.

By contrast, when citizens' approval of government is withdrawn, bridging and linking social capital is also diminished:

> It is a central thesis of the revised interpretation of the historical trends of construction and destruction of social capital ... that in a liberal democratic society with a market economy, bridging and linking social capital can only grow and flourish in tandem with citizens' positive endorsement of the organs of the state....When citizens are disillusioned with government, they engage predominantly in defensive, self-interested bonding social capital only; when they have faith in the state and in their subsidiary levels of government, they are more likely to participate in bridging and respectful democratic linking social capital. (601)

For Szreter, there is a political economy of social capital. The rise of identity-based politics, often with religious overtones, was connected to the demise of bowling leagues and the loss of other forms of social capital observed by Putnam. Each was caused by a more underlying force: a systematic campaign to undermine citizen confidence in government, which in turn was part of an economic program that eroded social services and exacerbated inequality.

Szreter agrees with Putnam that lower-income communities are likely to exhibit lower levels of bridging and linking social capital than are more affluent areas. For Szreter, the rules of the economic game have been rigged against poor communities for decades, as

resources have been continually drained from low-income neighborhoods and cities. The poor have low opinions of government for understandable reasons when the state fails to provide an opportunity for entire neighborhoods to eke out a minimally reasonable livelihood. But the lack of resources also influences attitudes and dispositions toward other people: "Why should you respect and trust others...in a society that treats you in this way? Note, incidentally, that this is an extremely 'rational' response. The poor would be foolish to adopt any other attitude" (609). Szreter maintains that the lack of bridging and linking social capital in poor communities allows self-defeating bonding social capital, as exemplified by teenage gangs, to become predominant.

This analysis, then, depicts a political economy of social capital. In Szreter's view, the lack of resources, faith in government, and linking social capital are all mutually reinforcing. Without the social capital that is needed for competitive political systems, local governments would be expected to be less effective in lower income neighborhoods.

Szreter uses a broad historical analysis to support his theories, presenting a view of the rise and fall of the progressive movement. Szreter and Putnam resemble one another in their empirical method. The work of each theorist implies that relationships between civic engagement, governmental effectiveness and political culture can best be described by using an interpretive method with a long time horizon.

Szreter's work provides a framework for theorizing the relationship between individual and group vulnerability at the community level. If Szreter is correct, then communities exhibiting a high level of adaptive capacity will also be characterized by high levels of professionalism in government, high levels of social capital and competitive political systems.

To say that a political system is competitive does not necessarily imply that every election is close. Rather, it means that office-holders can count on credible challenges if they fail to be responsive to their constituents. Actively engaged citizens know what to ask for from local government, expect results, and are prepared to back a challenger if government fails to respond. An example of the integration of civil society and government illustrate the point. A gardening club wanted to donate labor and materials to plant flowers in a commercial district. They asked the city to provide planters. The alderman and mayor were quick to respond. The citizens knew who to ask and how to ask, and what to ask for. Local officials knew that rival candidates would have been happy to promise planters to the garden club if incumbents declined to do so.

A competitive political environment is not necessarily caused by rival factions competing for the spoils of government. Instead, a competitive environment is a byproduct of an organic connection between civil society and government. In a well functioning democracy with a strong civil society, failure of a local government to respond to the needs of constituents will be a self-correcting problem. When citizens value the services that their local government provides, political actors will be eager to take credit for providing these services.

5.2 Regime Analysis

Clarence Stone (2005) has been a leading figure in the development of regime analysis, an analytical framework that has dominated discussions of urban politics over the last 15 years. A central question addressed by regime analysis is: How can local government actors achieve the capacity to accomplish significant goals on behalf of cities?

Stone (2005) identifies four key elements that comprise regime analysis. The first concept is that of the governing coalition. This is the combination of public and private actors that work together to govern the city. The governing coalition cannot be confused with an electoral coalition, which cooperates to elect a set of candidates. Rather, a stable governing coalition can last decades, longer than any individual's tenure in public office. A governing coalition requires a partnership between the public and private sector because no government can manage all facets of life within a city. Markets and other institutions play key roles in shaping the way of life in cities. When public and private actors are able to reach accommodation to achieve common goals, a governing coalition is achieved. Analysts sometimes use the term "governance" to describe the broad set of institutional arrangements that govern a city; this is opposed to "government," which deals only with the realm delegated to the public sector (Kamath 1).

A second element in regime analysis is a shared agenda. This is the set of policies that the governing coalition agrees to pursue. Stone (2001) identifies four general agendas that are associated with different types of regimes. A caretaker regime is devoted to maintaining the privileges of the dominant stratum in a city, with a focus on low taxes and minimal social services. Economic development regimes focus on construction of major projects, as well as on promoting new commercial and residential development. Middle class progressive regimes seek to limit growth and to preserve open space and other natural resources. Finally, opportunity expansion regimes seek to expand economic opportunities to excluded members of society.

A third element in regime analysis is resources. Stone argues that a group or individual must possess some resources in order to be an attractive coalition partner. Resources can be

financial, electoral, or intellectual. The fourth element is a scheme of cooperation, or a way for coalition partners to communicate and coordinate their actions.

Stone (2005) places regime analysis in the context of the tension between structure and agency. Cities function in an environment shaped by the global economy as well as by federal policy. Regime analysis looks at how the actions of local policy makers fit into these larger forces: "Structures are reinforced, challenged, and modified by agents that operate from considerations that are more immediate and complex than submission to broad structural processes....Because structures both constrain and enable, details of how they mix assume importance" (323).

Stone maintains that low-income individuals are poorly positioned to take part in the governance of their communities:

> Faced with political, social, and economic obstacles to exit, disadvantaged populations have had to cope with a history of marginality and confinement to aging urban areas. They are weakly connected to the political and civic life of cities and have no ready means of mobilization--along with little confidence that it would make a difference even if attempted. Often alienated from both schools and police and subject to damaging stereotypes, disadvantaged populations are weakly positioned to become part of the fabric of governing. (327)

Like Szreter, then, Stone believes that low-income individuals are likely to have few connections to the coalition that governs their cities.

5.3 Toward a Theory of Adaptive Capacity

Regime analysis and social capital theory both contribute ideas that are relevant to the adaptive capacity of communities. Regime analysis focuses attention on the nature of governing coalitions. Social capital theory contributes a richer picture of civil society, and

the ways in which individuals can be empowered to or excluded from participating in civic affairs. Borrowing ideas from each of these theories, I advance the following theses about adaptive capacity at the community level:

First, adaptive capacity requires a high level of professionalism on the part of city government. Professionalism entails technical knowledge, skill at forming collaborations between departments as well as between government and private entities, the ability to engage in proactive problem solving, and a commitment to effectively and efficiently deliver services to the entire community.

Second, professionalism in city government is encouraged by the presence of a broad-based governing coalition. To say that a governing coalition is broad-based means that groups in the governing coalition represent a broad cross-section of society, and that most citizens will therefore have access to at least some group in the governing coalition. In this situation, few will be systematically excluded from the governance of their communities. A broad-based governing coalition will require the municipal bureaucracy to be responsive to the whole community. Politicians then will compete on the basis of their ability to effectively and efficiently deliver services to all citizens. A broad-based governing coalition, then, forces local government to develop an orientation to the common good. This encourages the kind of professionalism described above.

When a city has a governing coalition that is not broad-based, it may be said to be "polarized." In a polarized city, the government will be oriented to the project of delivering privileges to one group at the expense of another. The caretaker regimes described by Stone are characterized by distinct groups, one privileged, the other excluded. These regimes are

devoted to preserving the status quo and maintaining the privileged position of those in the governing coalition. These regimes offer low taxes and minimal municipal services.

Other examples of polarized cities might include patronage states, in which city government is seen by politicians as a tool for rewarding political supporters, and for excluding political opponents. In such a state, loyalty rather than professionalism might be expected to the primary virtue in city government. A more extreme case might be a city whose leaders use local government as a tool for personal enrichment, either of themselves or of their cronies. Caretaker regimes, patronage and cronyism are all examples of ways in which the polarization of a city would not be conducive to developing the professionalism required for effective adaptation.

Third, adaptive capacity is encouraged by the presence of a stable governing coalition. Without a stable governing coalition, a city will lack the capacity to unite around significant projects and accomplish major goals.

Fourth, cities with a large number of economically and socially marginalized individuals will tend to exhibit lower levels of adaptive capacity. This is a corollary of the observation that polarized cities are less likely to develop highly professional governments. Szreter and Putnam both argue, in slightly different ways, that the poor are likely to be excluded from governing coalitions. For Szreter, the inability to earn a livelihood will encourage cynicism about government, and will foster the sort of bonding social capital that does not lead to civic engagement. Moreover, the exclusion of a large group of people from the governing coalition will not be conducive to developing the sort of generalized trust that results in effective and efficient service delivery for all citizens. Stone agrees that poverty breeds

cynicism, and further notes that the poor are less likely to have the resources needed to be attractive partners in a governing coalition.

It is possible for a city with a tradition of inclusion to build a governing coalition that includes even persons and neighborhoods with limited financial resources. Still, polarization in governance is the most likely outcome of socio-economic polarization. It this is the case, then successful adaptations should be less likely in municipalities with high levels of poverty and other forms of social exclusion.

In the following chapter, I build on my quantitative findings through a comparison of Louisville and New Orleans. Following Giddens, I first focus on the actual practices employed by municipal officials as they exercise their agency within the federal system. Next, I aim to describe the social and political context in which these practices occur .

Chapter 6: Louisville and New Orleans: Race, Politics and Adaptive Capacity

6.1 Introduction

In previous chapters, I drew on structuration, social capital and regime theory to provide an explanation of why adaptive capacity appears to be related to indicators of socio-economic status at the community level. In this chapter, I apply these concepts to two cases, Louisville, Kentucky and New Orleans, Louisiana. Although each city has seen significant flooding in recent years, the level of devastation cannot be compared. The effects of Hurricane Katrina are probably unparalleled in modern American history, while the river flooding experienced in Louisville was serious, but not unprecedented.

It is still worth examining the stories of these two cities in order to provide a deeper understanding of the political and social dynamics that shaped the two cities' responses to floods. The comparisons are useful to provide a sense of the variation in response to flooding and natural disasters. The aim of this comparison is to provide a richer description of the environmental risks, as well as of the social and political factors that influence flood planning and response.

The previous chapter concluded that several factors are conducive to the development of adaptive capacity:

- Leadership from a strong business community
- Engagement of non-governmental organizations in the governance of a community
- Inclusion of persons with limited means in the governance of a community.

Thus, after sketching the comparative method to be used, the chapter next offers a comparison of the demographics and flooding risk in the two cities. Then follows an assessment of the level of adaptive capacity demonstrated by each city. Finally, I examine business leadership, NGO engagement and inclusiveness in the two cities.

6.2 Comparative Method

Outlined below is a framework for conducting an interpretive historical synthesis, including case selection and sources of information. The chapter concludes with a discussion of the strengths and weaknesses of this approach.

The previous chapter outlined a theory to explain the relationship between SES and adaptive capacity at the community level. The causal chain proposed was as follows: (1) The socio-economic composition of a community affects the social capital in that community. Social capital is defined by the type of discourse between citizens and the level of engagement in civic organizations. (2) The types and levels of social capital in a community affect the governance of a community, including the composition of the governing coalition and the level of professionalism seen in municipal bureaucracies. (3) The type of governance in a community affects the adaptive capacity of that community.

How can one assess the adequacy of a causal model such as this? To do so, a method must capture the interconnection, and co-evolution, of the following social phenomena: systems of social stratification, governance and adaptive capacity. The term "co-evolution" implies a diachronic element. Needed is an approach that embraces path-dependence, to use neo-institutionalist language, or the idea that actions of agents in one time period are shaped by conditions inherited from previous periods (North 1981).

A historical comparative method is a natural approach to use in exploring complex causal relationships that unfold over time. Pierre (2005) draws on literature in comparative politics to argue for the use of "comparison as a heuristic device" in explaining differences in urban governance:

> By describing the cases in a holistic fashion, highlighting the internal logics of each of the cases while at the same time teasing out changes in the variables identified by the analytical framework, the final analysis will both set the stage for meaningful comparison as well as tell a good story. An important element of comparative research is not just to isolate causal processes but also to present the cases as a set of interrelated economic, political and social processes embedded in an institutional system. These contextual accounts--some would say narratives--have very much to offer in terms of the overall *Verstehen* of the individual cases. Peter Evans (1995) describes this type of process of developing scientific explanation nicely: 'The overall result is a mosaic of concrete evidence melded by an argument that is abstract and general. If the combination convinces, it is not because each piece of evidence or link in the argument is irrefutable. It is because the overall gestalt makes sense.' (456)

This quotation speaks to the need for complex causal relationships to be explored through a narrative that weaves together social, economic and political phenomena. To this extent, the method proposed by Pierre overlaps with Historical and Comparative Institutional Analysis (HCIA), a fairly new method that has arisen out of neo-institutionalist economic thought. As described by Greif (1998), HCIA is "a particular conceptual framework and empirical methodology" that is used to address "questions regarding the origins, nature and implications of institutions and institutional change" (80). In Greif's formulation, HCIA draws on game theory and other bodies of thought "to study the process through which decision makers with particular traits, such as specific organizational features, preferences, or habits, emerge and the constraints on behavior that their interactions entail" (81). HCIA has most frequently been used to analyze economic differences between nations. However, Greif argues that "more broadly, it indicates the importance of examining a society's self-enforcing

endogenous institutions as products of a historical process in which past institutional, economic, political, social and cultural features interact in shaping the nature of contemporary institutions and their evolution" (82).

As noted above, economic practitioners of HCIA often use game theory as a point of departure in their historical-theoretical inquiries. However, the link to game-theoretic frameworks has been relaxed by sociologists influenced by neo-institutionalism and HCIA. Nee (2003) notes that contemporary sociologists working within a neo-institutionalist framework use a "behavioral assumption emphasizing nonrational action molded by codified and legitimated beliefs, scripts, myths, rituals and rationalized stories" (45). Among the theoretical influences on the neo-institutionalist sociology cited by Nee are the ethnomethodology of Garfinkel, the symbolic interactionism of Goffman , the sociology of knowledge of Berger and Luckmann and Bourdieu's theory of practice.

Drawing together elements of comparative politics and HCIA, I offer four main steps for a method of comparative institutional synthesis. The first step is case selection. Pierre (2005) suggests selecting cities that differ on a key outcome, but that otherwise are as similar as possible. I argue that Louisville, Kentucky and New Orleans, Louisiana differ with respect to adaptive capacity, but otherwise have important similarities. The two cities are both southern, which eases the concern that region might explain outcomes. The two cities are both fairly large, which diminishes another potential explanation. In addition, the two cities have both experienced some significant flooding risk in the 20th century, although admittedly the challenges faced by New Orleans were greater than those faced by Louisville.

The second step is to use a causal model to identify key institutions that have affected the dependent variable. Using the theoretical framework outlined in the last chapter, regime

theory provides a language to use in describing institutional influences on adaptive capacity. The composition of the governing coalition, the agenda of the governing coalition, and the rules that facilitate cooperation among members of the coalition are all institutional variables.

The third step is to identify factors that explain the emergence of institutions. I argue below that race relations in the two cities may account for some of the differences in governance observed.

The final step is to construct an historical narrative through which inter-relationships between institutions, factors and outcomes "hang together" in a manner consistent with the causal model.

The selection of sources is a major issue for an analysis such as this. The sources varied somewhat by city. To support the contention that Louisville exhibits a high level of adaptive capacity, I relied primarily on local planning documents, including the floodplain management ordinance, the Floodplain Management Plan of 2001 and status reports. An important piece of corroboration was FEMA documentation that Louisville is one of fewer than 30 cities that has achieved a Level 5 CRS rating. There were also a few newspaper articles shedding some light on the city's success in reducing flooding risk.

The appraisal of adaptive capacity in New Orleans is based on both post-Katrina academic literature and contemporary news reports. From both sources, special attention was given to reports that relied on observations of participants or observers.

By necessity, evidence on governance and race relations rely mostly on secondary sources. For New Orleans, there is a fairly rich literature on the city's political history. Some triangulation is possible inasmuch as the sources span several decades in time, and represent different types of analysis. For example, the narrative of governance during the mayorships

of Robert Maestri and DeLesseps Morrison relies heavily on the historical writings of Edward Haas, a distinguished historian now at Wright State University. However, his conclusions are consistent with Adam Fairclough's history of civil rights in Louisiana, as well as by a 1969 report issued by the Center for Urban Education in New York.

Not as much urban history has been written on the City of Louisville, but there are still several excellent sources. Wright's 1985 history of the African American experience in Louisville between 1865 and 1930 provides extensive evidence on race relations in the early 20th Century. The story told by Wright dovetails with the writings of a pair of contemporary observers from the 1950s. Kesselman's 1957 article on voting rights in Louisville and Braden's remarkable first person journalistic account of race relations are very useful documents. The conclusions gleaned from these sources correspond to K'Meyer's 2004 work, which draws heavily on newspaper reports regarding race relations in Louisville in the 1950s. Mayor Wilson Wyatt's memoirs are also cited. Contemporary writing on the Louisville Area Development Association are also complemented by more recent historical accounts. A variety of public documents and a recent doctoral dissertation help paint a picture of governance in Louisville since 1990. Thus, a variety of sources from both cities aid in the effort to construct a defensible narrative.

The central argument in this section of the chapter is that a historical comparison of institutions is *per se* a legitimate research method. Although it relies heavily on secondary sources, it is not simply a literature review or a scoping exercise[3]. The method asks new questions of the historical record and combines historical accounts in new ways to create a new synthesis of information. It is a theory driven exercise that devotes attention to the

[3] To be sure, a comparative analysis of institutions could be used to "map fields of study" for future research, and used in this way could serve a valuable purpose. For a description of scoping study methodology see Arksey and O'Malley (2005).

selection of both cases and sources. It is not a weakness that the method relies heavily on secondary sources. This may be considered a strength, as it builds on the work of experts in diverse fields to reveal connections.

The historical comparison of institutions is well established as a tool of social inquiry. Excellent examples include Chapter 5 in Making Democracy Work (Putnam 1993), as well as the Szreter (2002) article frequently cited in this dissertation. Another comparativist, Theda Skocpol (1979), articulated the process as follows:

> Inevitably, broadly conceived comparative historical projects draw their evidence almost entirely from 'secondary sources' - that is, from research monographs and syntheses already published in book or journal-article form by the relevant historical or culture-area specialists. The comparative historian's task - and potential distinctive scholarly contribution - lies not in revealing new data about particular aspects of the large time periods and diverse places surveyed in the comparative study, but rather in establishing the interest and *prima facie* validity of an overall argument about causal regularities across the various historical cases. (xiv)

There are clearly some weaknesses associated with the comparison of institutions, as is the case with any research method. The first is the "small-n" problem. It can be dangerous to try to draw general conclusions based on a small number of examples. Second is the problem of sources. When studying the past, some sources have been lost, and a researcher must depend on information that others have chosen to preserve. The best way to compensate for this risk is to use different types of sources and sources from different time periods, although the problem can never be eliminated. A third issue is the suggestive nature of comparative institutional studies. If the goal is to construct a narrative of political, social and economic relations (as Pierre has written) or to construct a *prima facie* case regarding causal relations (as Skocpol states), then the importance of the researcher's own subjectivity must be acknowledged. Comparative institutional studies raise the need for other such

studies to provide corroboration. Ideally, comparative institutional studies will also generate hypotheses that can be analyzed through quantitative methods. Thus, a study such as this should be considered as a starting point for further inquiry, rather than the last word on the subject.

Despite these weaknesses, a comparative institutional method has a place in social research, and has become a common method in political science, sociology, and other disciplines. My aspiration in crafting this chapter has been to emulate the comparative method used so effectively by Putnam, Szreter, Skocpol, and many others.

6.3 Demographics and Geography

Louisville and New Orleans are comparable cities in several ways. They are both large southern cities with a significant African-American population, and each has experienced major flooding over the last century.

Both cities' populations changed drastically since the 2000 Census. In 2003, Louisville merged with surrounding Jefferson County to form a new municipal government (Gamrat and Haulk 2005). The move more than doubled the population of the City of Louisville, making it the country's 16th largest city. In New Orleans, the size of the population was roughly halved following hurricane Katrina. Table 6.1 shows some basic demographics for the two cities from the 1950 and 2000 Censuses, and from the 2006 American Community Survey.

In the 2000 Census, the poverty rate[4] in New Orleans stood at 28%, compared to 22% for Louisville. Louisville had a slightly higher per capita income, $18,193, compared to $17,258 for New Orleans.

Table 6.1 Comparative Demographics

	City of New Orleans	City of Louisville
1950 Census		
Population	570,445	369,129
Percent African American	32	16
2000 Census		
Population	484,674	256,231[1]
Percent African American	67	33
2006 American Community Survey		
Population	223,388	701,500[1]
Percent African American	59	20

Both cities have experienced significant flooding events. The Great Flood of 1927 threatened New Orleans. Major damage to the city was avoided partly because of a decision to dynamite agricultural levees in the unincorporated village of Caernarvon, about 15 miles from the City (Lane, Day and Thobodeaux, 1999). This, and other levee failures upstream, helped to keep the New Orleans levee system intact. Hurricane Betsy, at the time the costliest hurricane in U.S. history, struck New Orleans in 1965. In an article marking the 40th anniversary of the storm, Brian Williams notes that the storm caused more than $1 billion in damages and resulted in 75 fatalities, mostly in the City of New Orleans (*New York Times*, September 24, 2005). Four years later, Hurricane Camille struck the Mississippi Gulf Coast. Camille was the second Category 5 hurricane to strike the United States. Although it did not directly strike New Orleans, it was a near miss (Jarrell et al 2001).

[4] The 2000 population count occurred before the City of Louisville merged with the rest of Jefferson County. The 2006 estimate reflects the population of the City after merger with Jefferson County.

It must be acknowledged that the flooding that Louisville has experienced cannot compare with the devastation visited upon New Orleans. Still, Louisville has experienced major flooding approximately once every ten years since its founding (Louisville/Jefferson County 2001). Particularly significant floods occurred in 1937, 1964 and 1997. The 1937 flood covered 60% of the city and forced tens of thousands of evacuations. In 1964, more than 1,200 homes were flooded. The 1997 flood is discussed below.

6.4 Adaptive Capacity

Louisville: Louisville's successful efforts to manage flooding risk in recent decades demonstrate a high level of adaptive capacity. A significant piece of evidence is the city's achievement of a Level 5 rating in the CRS program. This places Louisville among only 30 municipalities nationwide that receive flood insurance discounts of 25% or more through participation in CRS, out of more than 20,000 communities that participate in NFIP. Louisville is the second largest city to participate at CRS Level 5 or better, with only Phoenix surpassing Louisville in population among the top municipal CRS participants (U.S. Department of Homeland Security 2008).

Key factors that earned Louisville a Level 6 rating were activities related to public awareness, mapping and floodplain regulations, flood damage control and flood preparedness (Louisville/Jefferson County 2002, Louisville/Jefferson County 2004a).

The City earned public awareness points through an annual coordinated mailing and media strategy aimed at property owners, realtors, lenders and insurers. The public awareness campaign seeks to inform the public about both flooding risks and about regulations governing structures located within floodplain areas (Louisville/Jefferson County 2002, Louisville/Jefferson County 2004a).

A central feature of the City's mapping efforts has been the deployment of the Louisville-Jefferson Information Center (LOJIC), an online mapping system that provides information about flooding risk. Louisville also received points for preservation of open space and adoption of a building code that meets the Building Code Effectiveness Grading Schedule (BCEGS) classification of 6 (Louisville/Jefferson County 2004a). Its revised floodplain ordinance has been emulated by other communities throughout the country (Louisville/Jefferson County 2005).

Louisville earns credits in the flood damage reduction category by successfully seeking federal and state grants that allow buyouts of repetitive loss properties. In addition, after the 1997 flood, Louisville has provided backflow valves to property owners to prevent sewer backups in basements. Extra credit is provided for maintenance of drainage systems and enforcement of dumping regulations (Louisville/Jefferson County 2002, Louisville/Jefferson County 2004a).

Finally, Louisville earns credits in the flood preparedness category for strong emergency response planning. Planning efforts involve several public agencies and non-governmental organizations, as detailed below (Louisville/Jefferson County 2002, Louisville/Jefferson County 2004a).

. The effectiveness of Louisville's flood protection system was seen during the flood of 1997 (Louisville/Jefferson County 2001, Louisville/Jefferson County 2006a, Louisville/Jefferson County 2006b). Again, a two week flooding event is not comparable to the impact of Hurricane Katrina. Still, Louisville's response demonstrates effective planning, and a system that worked well under stress. The heaviest 24-hour rainfall in Louisville's history caused, over a two week period, both serious inland ponding and flooding along the

Ohio River (Louisville/Jefferson County 2004b, U.S. Department of Commerce 2008). Although flood damage was estimated at more than $200 million, there was only one fatality in the Louisville area, a motorist attempting to drive through a flooded gulley. In Jefferson County, over 4,300 homes were either destroyed or seriously damaged (Associated Press, March 28, 1997). Emergency evacuation of two residential neighborhoods, as well as a flooded trailer park, occurred without incident. The Kentucky National Guard collaborated with Louisville emergency management operations to rescue individuals trapped in their homes by inland flooding (Louisville/Jefferson County 2004b).

The LOJIC system described above was a significant asset to the emergency response effort. LOJIC produced thousands of maps during the flood event, supporting efforts of the fire department, the police department, the health department, public utilities and FEMA. LOJIC was able to accurately model likely flooding, given expected rainfall and topography. This information was used to direct emergency responders to specific addresses (Louisville/Jefferson County 2004b).

The city's ongoing maintenance and construction of flood walls was credited with sheltering most of the town from the river flooding (*Winnipeg Free Press*, March 8, 1997). The city built 17 miles of flood walls between 1948 and 1957. Another 12 miles were added over the next 30 years (*New York Times*, March 8, 1997). The flood walls are not a passive system, as gates must be shut by city personnel, and as sandbags are needed to supplement the floodwall system. According to Laura Goldberg writing in the *Cincinnati Enquirer* (March 9, 1997), the city conducted regular drills to ensure that the floodwall gates and communication systems were in good working order. A report printed in the *Houston*

Chronicle (March 8, 1997) quoted Mayor Abramson as noting that 90,000 sandbags had to be filled and deployed to supplement the city's flood walls during the crisis.

Following the crisis, the Red Cross set up seven service centers and five shelters. MSD immediately reacted to the flooding by establishing a program to provide backflow valve devices to homeowners to prevent backup of sewer water into basements (Louisville/Jefferson County 2004b).

In the years since the 1997 flood, Louisville has continued to succeed in three key areas: inter-departmental collaboration, inter-governmental collaboration, and collaboration with civil society. The five year floodplain management plan of 2002 and its subsequent implementation demonstrates effectiveness in each of these areas.

Floodplain planning in Louisville involves the coordination of several departments of city government (Louisville/Jefferson County 2002, Louisville/Jefferson County 2001). As the lead local agency for the National Flood Insurance Program, the Metropolitan Sewer District (MSD) coordinates all aspects of floodplain management. The city planning department has drafted ordinances and regulations such as a rule to protect water quality around sinkholes. The Emergency Management Agency has developed a comprehensive cleanup plan, identified shelter sites in collaboration with the Red Cross, and purchased rescue boats. The Fire Department has engaged in water rescue training to prepare for disasters. The Public Works department has maintained a master address file, undertaking the arduous task of resolving duplicate and non-standard addresses throughout the newly consolidated city. The Health Department has created plans for communicating with the public regarding health risks following a flood. A representative of the Mayor's Office sits on the floodplain management committee to ensure coordination among city departments. Thus, planning for

flood mitigation and response has revealed a city government capable of cooperating across agency lines in support of a coordinated strategy.

The City has also formed effective partnerships with both state and federal government agencies. Examples include successful applications for grants, including $2 million from the U.S. Department of Housing and Urban Development for the purpose of installing free backflow devices in basements, and $6.4 million in grants for the purpose of buying and demolishing repetitive loss structures. Louisville has also received grants from the state Emergency Management Agency totaling in the millions (Louisville/Jefferson County 2004a).

The business community and non-governmental organizations (NGO) have also played key roles in implementing the floodplain management plan. Business interests, primarily represented by the Home Builders Association and the Board of Realtors, have participated actively in promoting floodproofing standards and conducting outreach in the construction and real estate communities. A variety of NGOs have participated actively in the community's floodplain management effort. Groups include the Red Cross, the Humane Society, and several advocacy groups (Louisville/Jefferson County 2001).

The Red Cross has assumed significant responsibilities. First, it coordinated public outreach through the development of printed materials, a media campaign and a speakers bureau. Secondly, it organized volunteer groups to determine the needs of elderly and disabled populations in the event of an emergency. Third, the Red Cross collaborated with emergency management officials in selecting evacuation sites, which it has staffed in times of emergency (Louisville/Jefferson County 2001, Louisville/Jefferson County 2002).

Louisville's flood management systems have not been stressed as severely as have those in New Orleans and other cities. Still, Louisville gives the appearance of a city that has accurately assessed its risks, planned for emergencies, formed partnerships and implemented responses. Its excellence in floodplain planning and management has been certified by an independent organization, as reflected in its CRS rating. It seems reasonable to conclude that Louisville is a city with a high level of adaptive capacity.

New Orleans: After Hurricane Katrina, New Orleans epitomizes a city with a low level of adaptive capacity. Images of stranded persons on rooftops and in the Superdome are now burned into the collective memory. In the 2000 Census, New Orleans had a population of about 485,000 persons. Two years after the hurricane, the city's population stood at less than half that number, a clear example of a city that failed to adapt.

Defenders of the city's government argue, with some justice, that the largest failings in the wake of Hurricane Katrina were at the federal and state level. While it is true that failures occurred at all levels of government, there is strong evidence that as a community, New Orleans never achieved a high level of adaptive capacity.

Dreier (2006) notes that city government failed to form effective partnerships with other levels of government. After the disaster, federal, state and local officials all complained of communications breakdowns between levels of government, leading to Mayor Nagin's desperate outburst, "I don't know whether it's the governor's problem, I don't know whether it's the president's problem. But somebody needs to get their ass on a plane and sit down, the two of them, and figure this out" (Dreier 2006, 528). For his part, the Secretary of Homeland Security expressed frustration over his inability "to persuade Governor Blanco and Mayor

Nagin to sit down, get over their differences and work together" (Burns and Thomas 2006b, 521).

Burns and Thomas further report that City government had failed to form coalitions to engage in effective planning, despite the availability of potential partners in civil society. For two years, the local chapter of the Red Cross, in conjunction with the University of New Orleans, had proposed processes to begin planning for a major disaster. But these private actors were frustrated by the unwillingness of local government to engage in partnership with them. As Hurricane Katrina approached, Amtrak offered assistance in evacuating the city, but the City government did not respond. Burns and Thomas conclude, "even though resource-rich actors made assets available to New Orleans, the lack of open and regular channels among these groups made it impossible to execute this plan" (521).

Dreier (2006) notes other clear examples of failure on the part of the New Orleans city government. Most notably, while Tulane University managed to evacuate the patients in its hospital, patients at the city-run hospital were left to fend for themselves for several days after the hurricane. A *USA Today* report by Steven Sternberg (September 1, 2005) also indicates that evacuation of city hospitals did not occur. Another contemporary news report by Lise Olsen (*Houston Chronicle*, September 7, 2005) notes several planning failures related to hospitals and special needs populations. Several city hospitals had generators located in basements, a situation that left them vulnerable to power outages. Moreover, the city had at its disposal 550 different types of buses that it failed to use to evacuate hospitals and neighborhoods. Olsen also contrasts New Orleans with similarly at-risk cities in Florida such as Miami that maintain databases of special-needs populations for use in evacuations.

Olsen also claims that disaster preparedness experts from around the country were shocked by the lack of preparation in New Orleans:

> The consequences came to bear in the images hours and days later: Elderly people dying outside shelters and hospitals that were losing power and, finally, their patients. Now, hurricane evacuation experts around the country are asking why New Orleans failed to prepare for the flood scenario from a Category 4 or 5 hurricane. 'Everybody knew about it. There's no excuse for not having a plan,' said Jay Baker, a Florida State University associate professor who is an expert in hurricane evacuations and is familiar with New Orleans hurricane studies.

Some private hospitals in New Orleans also failed to evacuate. Most famous is Memorial Hospital, owned at the time by the Tenet Healthcare Corporation. Patients were stranded at Memorial Hospital after the facility lost power and plumbing, as heat rose to over 100 degrees. CNN reported (October 13, 2005) that some medical staff at the time discussed the possible use of euthanasia for suffering patients facing imminent death. Ultimately, at least 45 persons died in the hospital while waiting for evacuation, according to a *New York Times* article by Kirk Johnson (September 13, 2005).

The police department had a mixed record, with many officers failing to report for duty. In the immediate aftermath of the hurricane, the city's police superintendent estimated that about a third of the police force had abandoned their posts (Johnson 2006). By February, 2006, 128 officers were dismissed, or resigned while under investigation, for abandoning their jobs or neglecting their duties. An undisclosed number of police were suspended without pay for up to 120 days. It is difficult to pass judgment on the officers that did not report for duty, as many of them undoubtedly were forced to choose between duty to their city and duty to their families. For example, one officer who was dismissed had to evacuate and care for a disabled spouse. But the inability of the police force to function as an institution during the crisis shows another example of systemic failure.

New Orleans, as a community, does not deserve the full measure of blame for the disastrous response to Katrina, and few cities have faced the magnitude of systemic stress seen in New Orleans. Still, it must be noted that departments of City government failed at some basic tasks, such as taking care of patients in city hospitals. In the months and years leading up to the disaster, the city failed to form effective partnerships with other levels of government, or with actors in civil society. Despite available partners, the city failed to plan for a disaster that everyone knew would one day occur. It seems reasonable to conclude that New Orleans, as a community, demonstrated a fairly low level of adaptive capacity.

Adaptive capacity is not something that appears or disappears suddenly. Rather, it develops over time, within a broader social and political context. The following section outlines some key characteristics that formed the context for current floodplain management practices.

6.5 Race and Politics in the Postwar Era

Louisville: By World War II, politics in Louisville followed a common pattern, with business interests supporting the Republican Party, and immigrants and labor tending toward the Democrats. However, skillful leadership in the African American community had established blacks as a key swing vote in municipal elections (K'Meyer 2004, Braden 1999). As a result, elections in Louisville were competitive, and the Democratic party in Louisville avoided the connection with Jim Crow laws with which the party was associated in the South.

The African American community had strong leadership in Louisville since at least the World War I era. The Louisville chapter of the Urban League formed in 1913, and within ten years Louisville also had a branch of the National Association for the Advancement of

Colored People (NAACP), as well as an organization called the Commission on Interracial Cooperation (CIC). The influence of the NAACP was shown in 1918 when it petitioned Mayor George Smith to stop the showing of the film Birth of a Nation. Smith complied, making use of a Kentucky law that banned plays based "upon antagonism alleged formerly to exist between master and slave...." (Wright 1985, 239).

In the 1930s, blacks made up about 20% of the population of the City of Louisville. This group had gained the right to vote in the 1870s, and thanks to the large number of aldermanic seats, had some elected representation in city government. African Americans traditionally supported the party of Lincoln. In 1929, Republicans nominated an African-American, A.G. Edwards, for a state legislative race. Although Edwards lost, both parties nominated an African-American for the same legislative seat in 1935. The Republican, Charles Anderson, won (Kesselman 1957).

During World War II, democratic mayor Wilson Wyatt appointed blacks to positions on several regional commissions and boards, including panels dealing with the draft, housing and rationing. In the early post-war period, libraries and hospitals were desegregated with little controversy (K'Meyer 2004).

In the wake of the Brown vs. Topeka Board of Education decision in 1954, Louisville attracted national attention for its swift and peaceful implementation of school desegregation. The New York Times wrote “when the history of this proud southern city is written, this day will undoubtedly go down as a historic landmark....Even in the South, it was shown here, integration can be made to work without violence” (K'Meyer 2004, 49). K’Meyer (2004) notes several other articles about Louisville’s successful integration in national magazines,

with titles such as “The Quiet Zone,” “How to Integrate,” “The Quiet Way” and “It Works in Louisville.”

This is not to imply that Louisville was an idyllic exemplar of racial harmony. A darker side of the town was revealed in a 1957 incident. In that year, a white couple, Carl and Anne Braden, were approached by African American friends, Andrew and Charlotte Wade. The Wades asked the Bradens to purchase a home in an all-white neighborhood located in unincorporated Jefferson County, for the purpose of re-selling the home to the Wades. The transactions occurred, and the Wades moved into their home, only to be driven out by a bombing incident. Fortunately, no one was killed, and Andrew Wade went on to build a successful electrical contracting business.

The incident was recalled with remarkable objectivity by Anne Braden in a 1958 book, The Wall Between. Braden writes that although Louisville was segregated, it differed significantly from Alabama, where she had lived previously. Braden notes that she was surprised, upon moving to Louisville to become a newspaper reporter, at finding that African Americans had no barriers to voting. Other surprises followed:

> Another thing that immediately struck me as different in Louisville was the fact that when predominantly Negro organizations such as the National Association for the Advancement of Colored People or the Urban League held important meetings or when their leaders made statements on some subject related to civil rights, it was newsworthy. I wrote some of these stories myself, and sometimes they made front-page news. This was quite different from Birmingham, where from reading the daily papers at that time...one would have hardly known an NAACP existed in the city....I found too in my early days in Louisville that I was thrown with a number of white people who openly and without qualification opposed segregation (Braden 1999, 37).

Severe racial injustice clearly persisted in Louisville in the 1950s. It does not diminish the very real inequities to note that in Louisville, in contrast to many other cities at the time, African Americans at least had a seat at the table. With unrestricted voting rights, elected

officials and strong civic organizations the African American community played a role in the governance of the community.

In the 1940s and 1950s, Louisville gained a reputation for progressive, forward-thinking mayors. Mayor Wilson Wyatt gained a national reputation for his wartime leadership in Louisville. After World War II, President Truman named him to head the National Housing Administration, a precursor to the Department of Housing and Urban Development. Wyatt was also sent on a mission to North Africa to lead a response to food shortages in that region, and was offered the position of Under-Secretary General of the United Nations (Wyatt 1985).

Wyatt was succeeded by E. Leland Taylor, who made his mark on the region's transportation system by acquiring land for expressways. After Taylor came Charles Farnsley, who is still respected for his investments in public works and efforts to bring Louisville's infrastructure up to modern standards (Naber 2001).

As in the rest of the South, democrats were the strongest party in Louisville until World War II. However, the Republican party maintained enough strength that it was able to elect several mayors. Between 1890 and 1933, the Mayor's office switched parties eight times. In the post-war period, democrats dominated local government in Louisville. However, Republicans also won mayoral races in 1961 and 1965 (University of Louisville Libraries 2006).

In the 1961 election, water and sewer infrastructure were pivotal issues. The Republican candidates for Mayor of Louisville and Jefferson County Judge proposed a bold plan to merge all of the water, drainage and sewer authorities under the aegis of a unified Metropolitan Sewer District (MSD). The new entity was to be given authority to charge rates for service. The Chamber of Commerce and the major newspaper strongly supported the

plan, and the candidates were both elected to office. The Kentucky Legislature took more than two years to approve the plan with modifications, but the new MSD ultimately was created (Louisville/Jefferson County 2006a).

In the postwar era, planning in Louisville has been led by the business community in conjunction with city government, with substantial input from non-profit organizations and civic associations. Following is a brief sketch of two major planning initiatives. First, the Louisville Area Development Association (LADA) formed the basis for postwar development and infrastructure improvement in the 1940s. Second, Cornerstone 2020 represented a significant community planning project in the 1990s.

LADA was formed at the urging of Mayor Wilson Wyatt in 1943 (Vinsell 1944, Kramer 2001). Under Wyatt's encouragement, business and labor leaders came together to plan for Louisville's adjustment to a post-war economy. Business, labor and government all contributed financial support to the effort, and held seats on LADA's board of directors. The first director of LADA was Kenneth Vinsell of the University of Louisville.

The LADA process consisted of forming a series of task forces, each of which was responsible for issuing action plans. Subject covered by task forces included economic development, public health, education, arts, housing, parks, air quality, public buildings, transportation and welfare (Vinsell 1944).

LADA laid the groundwork for several important development projects, including construction of a floodwall, the Louisville Medical Center, the creation of a state license tax, several city parks, the relocation of the Kentucky State Fair grounds, and downtown redevelopment. By 1950, LADA had accomplished most of its goals, and merged with the Louisville Board of Trade to form the Louisville Chamber of Commerce (Kramer 2001).

A half century later, Louisville embarked on another major planning effort. Cornerstone 2020 was a seven year project, commencing in 1993, with formal adoption in 2000 (Sarah Jeffords, Regional leadership group to map out future direction, *Business First of Louisville*, July 28, 2006; Greater Louisville Inc. 2002). The report was drafted by more than 600 volunteers representing a diverse cross section of the community. The volunteer committee included many representatives of the business community, including several banks, UPS, utilities and the media. But also included were representatives of a variety of civic associations, including religious, neighborhood, philanthropic and non-profit organizations.

There were five main committees that were formed to write the plan: policy, urban form, livability, mobility and marketplace. The effort was strongly influenced by the new urbanist movement, and stressed pedestrian-friendly streets, integration between residential areas and public space, and compatibility between new development and existing character and scale (Greater Louisville Inc 2002).

The plan classifies each neighborhood as one of a dozen urban types, ranging from downtown business district to village. Each type of urban form is defined by a set of characteristics. New development is evaluated according to its compatibility with the character of the neighborhood. The plan aims to balance the need for economic development with the need for quality of life and progressive environmental management (Greater Louisville Inc 2002).

LADA and Cornerstone 2020 have some similarities. Both reveal the strong influence of a cohesive business community. While neither could claim that its participants were perfectly representative of the community, both included and obtained support from other

sectors of civil society. Finally, each was given crucial support by a strong and progressive Mayor.

The dominant figure in Louisville politics over the last quarter century has been Jerry Abramson, sometimes called the city's "mayor-for-life" (International Economic Development Council, 67). Abramson served thirteen years as Mayor beginning with his election in 1985. Terms limits blocked him from running for a fourth full term, but he was elected mayor of the consolidated city-county government in 2002, and again in 2006 (City of Louisville 2008).

Abramson has cultivated a reputation for hands-on management and for aggressively representing Louisville. He lists as major accomplishments his successful efforts to recruit large employers, major investments in downtown revitalization, reinvestment in the low-income West Louisville neighborhood and establishment of a beautification program called Operation Brightside (City of Louisville 2008). As mayor of the consolidated city and county, he takes credit for reducing the size of government by 10%, although some commentators dispute claims of increased efficiency (Savitch and Vogel 2004). Over the last 20 years, , Abramson has been called "one of the most dynamic mayors in America" by Newsweek, "one of America's top 20 mayors" by U.S. News and World Report (City of Louisville 2008) and "the closest thing Louisville has to a resident rock star" (Greenblatt 2002, 20).

In his years out of office, Abramson spearheaded the drive for the consolidation of Louisville and Jefferson County. As noted earlier, previous attempts to merge the jurisdictions had been unsuccessful. In the 2001 election, however, several factors came together to create electoral success. There were three principal rationales cited as reasons for

consolidation. First, Abramson and his supporters argued that greater efficiency would result from eliminating layers of government. Second, backers relied on civic pride, noting that the consolidated city would be the 16th largest in the country. Third, consolidation supporters argued that consolidation would facilitate economic development, as new businesses would not have to contend with the sometimes conflicting city and county governments. Observers note that Abramson's popularity was a decisive factor in the success of consolidation, as most Louisvillians correctly assumed that he would head the new government. Abramson was elected as mayor of the consolidated municipality with 73% of the vote, and was re-elected by a similar margin (Savitch and Vogel 2004).

Abramson's popularity and his public image yield some insight into the qualities that the Louisville electorate values in a public servant. Abramson is ostentatiously wonky, receiving plaudits from the press for his ability to speak at length and without notes on topics such as floodwater management. He portrays himself as innovative, dynamic and pragmatic, touting his success in attracting new business, as well as investment in parks and housing. Abramson's popularity is evidence that the qualities that he claims about himself are the things that Louisville's citizens desire in their government.

New Orleans: New Orleans governance in the period 1945-1970 has been characterized as a "caretaker regime," devoted to low taxes, minimal government services, segregation and maintenance of the status quo (Kilburn, 636). The post-war era in New Orleans began during the Mayoral administration of Robert Maestri, who served from 1936 to 1946. Maestri was an unlikely politician, inarticulate and socially awkward. But Maestri gained some wealth as a store owner and became the largest financial backer of Louisiana Governor

and Senator Huey P. Long. After Long's assassination, Maestri was a close ally of Long's brother, Earl, who went on to serve as Governor.

City government in this period was characterized by a spoils system, in which supporters of the Mayor received employment and city contracts. Maestri was implicated in the oil scandals of 1938, when federal investigators found blatant conflict of interest related to the regulation of petroleum companies, but state officials declined to prosecute the Mayor (Holloway 1941). The Mayor also reputedly accepted bribes from organized crime in return for turning a blind eye to prostitution and gambling (Haas 1972).

Whelen writes that "vice, corruption and favoritism dominated the later Maestri years…." (52). The city in this period kept white home owners satisfied by keeping taxes low and providing minimal government services. Streets and garbage collection were notoriously bad during this period.

African-Americans were excluded from city government during the Maestri administration (Haas 1972). Indeed, blacks lacked the ability to vote in the all-important Democratic primary until the all-white primary was outlawed by the U.S. Supreme Court in 1944. Blacks held few jobs in city government, and city facilities remained segregated.

1946 saw the election of DeLesseps "Chep" Morrison, a young veteran with a reformist image. Morrison did introduce some reforms, including limited hiring of African Americans for city jobs and the introduction of a civil service system. Despite these reforms, there was still much patronage in city employment, and police corruption remained common. Morrison remained a segregationist and was not above stooping to racial demagoguery when it suited his purposes, at times comparing freedom riders to Nazi storm troopers (Powell 1997).

New Orleans failed to achieve peaceful integration of schools following the Brown decision in 1954. White racists organized demonstrations that turned violent in opposition to school desegregation in the wake of a 1960 decision. The Mayor kept a low profile during the crisis, surfacing occasionally to claim that the protests were peaceful and orderly.

Privately he blamed the business community for lack of leadership. One confidante later quoted him as saying, "well if those SOBs aren't going to do anything, I'll be damned if I stick my neck out" (Fairclough 1995, 253). Writing nine years later about the City's failure to achieve peaceful desegregation, an observer characterized the city's business leaders as "a closed elite, hostile to outsiders, anti-Semitic, a stagnant inward-looking group that lacked civic consciousness and displayed more interest in prestige, tradition and family than in economic development" (quoted in Fairclough 1995, 254).

Business and government leaders failed to achieve a cohesive regime between the 1940s and the 1960s. Morrison's administration failed to accomplish several of its key goals, including the construction of a monorail, retaining the minor league Pelicans baseball team and relocating the port. Morrison had a particularly strong desire to retain the Pelicans. In the final seasons that the team spent in New Orleans, the Mayor went so far as to require City policemen and firemen to sell a quota of Pelicans ticket. This predictably resulted in policemen unloading their tickets on organized crime leaders in return for protection from arrest (Haas 1974).

Morrison was succeeded by Walter Schiro, an avowed segregationist. Schiro is best remembered for dragging his feet on efforts to improve racial relations. He rejected calls to convene a biracial commission on race relations, did not increase the employment of blacks in city government, closed a swimming pool rather than allow it to be integrated, and had one

black leader arrested when the activist attempted to meet the Mayor in City Hall (Fairclough 1995). The lack of a cohesive regime persisted in the Schiro administration, as evidenced by the Mayor's failure to construct a riverfront expressway (Weingrof 2005).

Maurice "Moon" Landrieu, elected Mayor in 1970, was a transitional figure in New Orleans politics. Landrieu was the first mayor to actively court blacks through the use of patronage. Sherman Copelin, an African-American ally of Landrieu, received a major service contract at the Superdome, and was allowed to control access to jobs at the stadium. Black employment in city government also increased significantly during this period. Landrieu had a prominent African-American aide, and supported the first black city council member (Whelen 1987).

Burns and Thomas (2004) argue that around 1970, New Orleans transitioned from a caretaker regime to an economic development regime. In the 1970s, downtown developers were successful in securing public funds for the Superdome, the convention center, and other major projects, often with federal and state support. Landrieu took advantage of federal funds to begin two other major economic development projects, Armstrong Park and Piazza d'Italia (Whelen 1987). These projects integrated park space with an entertainment district and hotel. Neither has been financially successful for the city.

Whelen (1987) argues that despite the modernizing influence of Landrieu, "there were continuities in New Orleans politics" (223). Machine politics, characterized by the use of contracts and employment to solidify political support, did not abate during the Landrieu years. Moreover, although middle-class African Americans received some benefits from city government in the form of jobs and contracts, lower class African Americans continued to have little influence in government. Perkins (2005) quotes Arnold Hirsch as commenting

that Landrieu "never confused the dispensing of patronage with the sharing of power, and while amenable to the former, never acceded the latter" (Perkins, 8).

Ernest Morial, elected in 1978, was the first black Mayor of New Orleans. The eight years of the Morial administration were years of turmoil. Morial was opposed by two major African-American advocacy groups that had prospered under Landrieu, and the Mayor was frequently thwarted by a city council bloc led by Sidney Barthelemy. Morial had to navigate through strikes by police and garbage collectors, and labor strife forced the cancellation of Mardi Gras in 1979. White voters never accepted Morial, as the mayor received just 13% of the white vote when he ran for re-election in 1982 (Perkins 2002).

Morial was succeeded by his council nemesis, Sidney Barthelemy, who became the second black Mayor of New Orleans. The Barthelemy era was a difficult time for New Orleans. The city's revenue base was devastated by three developments: the New Federalist programs of the Reagan administration, the oil bust, and accelerating white flight from the central city. In 1975, federal monies accounted for 25% of the city's operating budget. By 2000, the percentage had fallen to just 7%. In the 1980s, New Orleans lost more than 80% of its federal and state funding (Perkins 2002). Oil and gas revenues also declined precipitously in the 1980s, and 170,000 people moved from central city to suburbs between 1980 and 1988. Between 1985 and 1989, city revenues fell from $304 million to $270 million.

Barthelemy was forced to cut the size of the city payroll by more than 20%, and to seek ways to maintain the city's financial capacity. However, voters overwhelmingly rejected two proposals, one to impose a $195 fee for city services, and another to increase tax rates for city schools. Perkins summarizes the Barthelemy years as follows: "Cuts in state and federal funding, declining tax bases owing to white flight to the suburbs and downturns in vital

industries rendered Mayor Barthelemy impotent in uplifting conditions for poor and working class African Americans" (Perkins 2002, iv).

Burns and Thomas (2006b) describe New Orleans in the days leading up to Katrina as a "regimeless" city (517) . Lacking agreement on an agenda or a scheme of cooperation, New Orleans is governed by issue-based coalitions, or temporary alliances that lack the capacity to achieve long-lasting reforms.

New Orleans lacks strong leadership from the business community. The city has suffered a flight of businesses, and today has only one Fortune 500 corporation (Stehr 2006). Although the chamber of commerce sometimes influences policy, business leaders do not provide ongoing leadership and resources. Burns and Thomas (2006b) write that "the New Orleans of today does not have the requisite characteristics of a common agenda, a governing coalition, resources and a scheme of cooperation to be properly labeled a regime" (520).

A telling example occurred when the State of Louisiana attempted to sell naming rights to the New Orleans Superdome. In many cities, corporations have paid for the right to place their names and logos on sports stadia and arenas. However, when naming rights to the Superdome went on sale in 2001, not a single New Orleans business availed itself of the opportunity, even though the Superbowl, the Final 4 (men's and women's) basketball tournament, and the NCAA Division I championship were all scheduled for the Superdome in 2002 (Burns and Thomas 2006). The story demonstrates the lack of civic leadership in the New Orleans business community.

6.6 Comparing the Cities

To summarize the previous sections, Louisville has demonstrated a high level of adaptive capacity. Its efforts at floodplain management have been recognized by an independent auditing agency, and its systems performed within expectation during a severe flood in 1997. New Orleans has shown a low level of adaptive capacity. With tens of thousands of stranded citizens, abandoned hospital patients and paralyzed government, New Orleans failed to respond to a threat that had been anticipated for many years.

A look at some specific practices reveals reasons why the levels of adaptive capacity vary between the two cities. First, Louisville has demonstrated a strong municipal bureaucracy, capable of coordinating complex tasks among multiple agencies. By contrast, New Orleans bureaucracies failed to perform their core functions. Again, the severity of the catastrophe is an important mitigating factor. Still, incidents such as the inability of the City to evacuate its hospitals, when private hospitals were successfully evacuating, indicates that better performance could reasonably have been expected. Moreover, the need for an evacuation plan that took into account special needs populations should not have been a surprise to officials in a Gulf Coast city. The relative professionalism of the municipal workforce in the two cities is clearly a factor in the level of adaptive capacity shown by the two cities.

Second, Louisville city government works very effectively with civil society, while the New Orleans government did not. The role of the Red Cross in the two cities provides an excellent contrast. In Louisville, the Red Cross was brought into the planning process, and was able to perform important planning and implementation roles. By contrast, City officials in New Orleans failed to return the Red Cross's phone calls. This indicates a difference in

social networks in the two cities. In Louisville, governance is strengthened by partnerships between government and the private sector. In New Orleans, these partnerships were lacking.

Third, Louisville leaders have cultivated productive relationships with officials at other levels of government. Federal and state agencies have provided support for major capital projects, and success in the CRS program shows Louisville's ability to function effectively within federal rules. In New Orleans, relationships were not in place when the hurricane hit, and officials were unable to jumpstart a relationship in a crisis.

These relationships, within a city government, between levels of government, and between government and civil society, are all examples of social capital.

Probing a little more deeply, we might ask why the right kinds of social capital were present in Louisville, but not in New Orleans. A look at the history of the two cities provides some answers. In Louisville, there was a longstanding tradition of involvement in governance on the part of the private and non-profit sector. Business groups led planning efforts from LADA to the creation of MSD, to Cornerstone 2020, to the consolidation. Strong connections between business leaders and political leaders created a capacity to get things done. Louisville also demonstrated an ability to draw on the resources of the non-profit sector. Labor groups and the Urban League were included in postwar discussions about the future of the city, and advocacy and community groups played leading roles in Cornerstone 2020 and in the floodplain management plan. Lines of communication existed that allowed non-governmental actors to contribute their resources to the governance of the community. In New Orleans, by contrast, city elites historically did not support projects of regional significance, and focused more on preservation of privilege. There is strong

evidence that long standing habits of communication and collaboration between government, business and NGOs made governance in Louisville more effective, and the lack thereof led to weak governance in New Orleans.

These observations lead to a still deeper level of inquiry: Why did the right kind of social capital form in Louisville, but not in New Orleans, over the last half century? The evidence related to this question is much more open to interpretation, much more difficult to verify. But it is worth examining this question in the light of theory and available evidence. To this end, I assert that race probably played a significant role in shaping the type and level of social capital in the two cities.

This is not a novel thesis. In 1949, V.O. Key argued in his seminal *Southern Politics in State and Nation* that racial polarization was the critical factor in maintaining dysfunctional governments in large parts of the south. Key maintained that white populations in areas with large concentrations of African Americans felt threatened by African American aspirations, which made racial demagoguery the dominant feature of the political culture in these areas. The dominance of race-baiting populists, allied with an inward-looking aristocracy, led to weak and unprofessional government, with low taxes and substandard services. Key also found that southern regions with fewer African Americans were not as susceptible to racist demagoguery, and were more likely to achieve reasonably effective government, by southern standards.

The stories of Louisville and New Orleans seem consistent with Key's analysis. White supremacy led to weak government in New Orleans. Blacks were systematically excluded from participation, and elites focused on preservation of the status quo rather than providing for a common good.

Louisville had a smaller, but still significant black population. The African American community had shrewd and able leadership from at least the turn of the 20th century. The ability of the African American community to position itself as an important swing vote forced politicians to articulate a vision that would appeal to white and black voters alike. This helped to produce a line of visionary mayors, who formed lasting partnerships with the private sector and demanded excellence and professionalism in city government.

This line of reasoning is consistent with, the main theoretical argument in this dissertation, which is that inclusive cities are adaptable cities. The examples in this chapter lend some credence to the hypothesis that positive feedback loops occur in political systems that have the following characteristics: strong civic groups that represent a broad segment of the population, an engaged electorate with high expectations of city government, competitive elections, candidates who compete on the basis of their ability to effectively and efficiently deliver services, and a highly professional municipal workforce.

6.7 Conclusion

In Chapter 1, I drew upon the structuration theory of Anthony Giddens to suggest a method with which to explain the relationship between socio-economic aggregates and the adaptive capacity of communities. Essentially, the method was to focus on specific practices related to adaptation, and then to explain the processes by which those practices are constrained or enabled by structural elements. Structural elements include stratification by income, race or education.

In Louisville, many of the practices required for successful adaptation were based on the ability of key actors to form relationships—between actors in city government, between

municipal and other levels of government, and between government and civil society. In New Orleans, the opposite was observed. I then argued, with some support from V.O. Key, that historical patterns of racial polarization (for New Orleans) and relative harmony (for Louisville) may have influenced whether key institutional relationships were formed.

The evidence presented in Chapter 4 indicates that there is a statistical association between aggregated socio-economic characteristics and adaptive capacity at the community level. But although the statistical association is strong, this still does not entirely resolve the question of causality: *How* do average levels of educational attainment, for example, affect the ability of municipal officials to engage in effective and proactive planning? The historical survey presented in this chapter suggests that socio-economic averages do not directly determine the adaptive capacity of communities. Rather, a causal model consistent with the historical interpretation in this chapter is that socio-economic aggregates influence the type of social capital in a community. The type of social capital in a community influences the type of governance in that community, which in turn affects adaptive capacity.

The story that emerges from a comparison of Louisville and New Orleans is that the presence of a large socially excluded population makes it more difficult for the right kind of social capital to form--the kind of social capital that contributes to a broad-based governing coalition. Socio-economic averages are not the only influence on level and type of social capital in a community. Other important factors include leadership, historical choices made in earlier periods, struggle and even luck. Thus, the socio-economic composition of a place will not entirely determine the characteristics of social capital in that place. Still, individuals in a community with a high level of polarization, whether economic or racial, will probably find it more difficult to establish cooperative social relationships with persons in other social

groups. The historical interpretations offered in this chapter support the view that the relationship between SES and adaptive capacity is more complex than would be imagined solely on the basis of quantitative evidence.

Chapter 7: Theoretical and Policy Implications

This dissertation identified, and attempted to remedy, three gaps in the literature on adaptive capacity. First, there is a need for additional studies of adaptive capacity at scales smaller than the national level. Therefore, this study focused on the adaptive capacity of communities.

Second, quantitative studies tend to use very general proxies for adaptive capacity, causing a need for studies that address specific adaptations in specific places. This dissertation studied floodplain management, and specifically activities related to participation in the Community Rating System.

Third, there was a need to test, and then to explain, the relationship between SES and adaptive capacity at the community level. My quantitative chapter supported previous literature predicting a link between SES and adaptive capacity. My theoretical and historical chapters drew on social theory to provide a tentative explanation for the association between socio-economic averages and adaptive capacity at the community level.

This chapter concludes by considering theoretical implications, policy implications and questions for future research. I will briefly summarize the argument made so far, with an aim to integrate the theories proposed and to highlight areas in need of more research.

7.1 Theoretical Implications

The central theoretical issue raised by this study of adaptive capacity is the relationship between individual and group vulnerability. Why, exactly, would average education levels, or racial composition, affect decisions made by municipal officials? The causal link between

collective characteristics and effective contingency planning is not direct. An average level of educational attainment in a community is not a risk factor for flooding in the sense that smoking is a risk factor for cancer. To the extent that SES is related to the adaptive capacity of communities, it seems that a socio-economic characteristic is a marker for something else.

The quantitative work presented in Chapter 3 supports the previously assumed relationship between SES and the adaptive capacity of communities, prompting a turn to social theory in an attempt to explain the processes by which socio-economic aggregates become associated with risk management practices in municipalities. Drawing on structuration theory in Chapter 4, I argued for an explanation that focuses on practices--concrete actions taken by individuals. In structuration theory, practices are seen as the link between structure and agency (Giddens 1984; Frolich, Corin and Potvin 2001). A key question raised by this strand of theory is how practices are constrained by structure, even as the practices reproduce structure.

One piece of the answer is probably that SES aggregates have some relationship to fiscal capacity. A bigger tax base allows municipal governments to have bigger staffs, and this may allow for more effective governance.

But this is only a part of the answer. Many of the action steps required for success in the CRS program are low-cost, and some cities with high CRS ratings have shown the ability to leverage resources from federal and state government for costlier projects.

More importantly, both of the cities with effective floodplain management had a municipal workforce that sustained fruitful relationships. I identified four types of relationships that contributed to effective floodplain management: interdepartmental relationships within city government; links between municipal government and other levels

of government; links between municipal government and the business community; and links between municipal government and non-governmental organizations (NGOs). Fiscal capacity may affect the ability of city workers to maintain effective relationships. Although I initially hoped to statistically assess the extent to which fiscal capacity determined adaptive capacity, I did not succeed in addressing this interesting issue. This is a clear topic in need of further research.

Still, the ability of city workers to form productive relationships cannot be entirely determined by fiscal capacity. The practices involved in establishing a pattern of interaction--setting up meetings, regular phone calls and emails, sending copies of key documents to key players--are not cost-intensive.

Social stratification is an aspect of social structure. Is there a reason that stratification, as measured by socio-economic aggregates such as income or race, might affect the ability of municipal leaders and employees to form effective relationships? I turned to regime analysis and social capital theory to outline a possible process by which structure thus defined might constrain government actors regarding the practices entailed in the maintenance of productive relationships.

Regime analysis is premised on the assertion that elites in a city must have four characteristics to properly be considered a regime: a governing coalition, a shared agenda, resources, and rules for interaction (Stone 2005). The last of these is of principal interest here. Rules for interaction in this context may be thought of as the practices involved in establishing regular patterns of communication. These rules tell government officials who to call for assistance with a given problem, how information is customarily shared, and what informal networks are conducive to consolidating relationships.

Rules or patterns of interaction do not emerge in an instant. For example, any new mayor will undoubtedly have his or her own social network on which to draw, but a new mayor also inherits a group of stakeholders, and a way of doing business, from predecessors. In a city with a well-functioning regime, a new mayor will be presented with a set of institutional actors accustomed to interacting with government for the pursuit of shared goals.

Chapter 1 invoked Amartya Sen's concept of "functionings," a term that represents the menu of capabilities from which an individual can choose at any given time (Nussbaum 2003). The concept may be of use here. The menu of capabilities available to Mayor Nagin as Hurricane Katrina approached was restricted by the lack of longstanding ties between government, business, and NGOs. Mayor Abramson of Louisville, inheriting a long tradition of ties between government, business and NGOs, had a much broader menu of capabilities from which to choose as he reacted to the flood of 1997, and as he subsequently led planning efforts to improve floodplain management.

Thus, regime analysis supports the notion that the ability to form relationships is important for effective governance, and further hints that historical patterns of interaction between sectors of society shape the choices available to governing coalition members at any given time. But this does little to shed light on the question of why average SES levels might constrain the ability of key actors to form relationships. Social capital theory does contain some ideas related to that question.

Simon Szreter (2002), in his reworking of social capital theory, argues that a virtuous cycle occurs in communities where a healthy civil society leads social capital, of the bridging and linking variety, to form. In such communities, active and engaged citizens value the services their government provides. Widespread social networks allow respectful dialogues

to occur at multiple levels. In highly competitive elections, politicians are eager to take credit for effectively and efficiently delivering services. Drawing on Szreter's ideas in Chapter 4, I suggested that such an environment would allow a highly professional municipal workforce to develop.

Szreter argues that this beneficial arrangement is undercut by severe polarization. In a highly polarized community, the strongest type of social capital to emerge is the narrow, inward-looking bonding variety. The lack of respectful dialogue between communities creates a weak civil society, allowing an "us vs. them" politics to emerge. The political imperative in such places is to use the power of government to grab privileges for the in group, and to exclude the out-group. The system rewards cronyism and corruption rather than the articulation of a vision for the common good.

In Chapter 5, I drew upon Szreter's theory to offer an interpretation of differences between New Orleans and Louisville. In brief, I suggested that racial polarization destroyed civil society in New Orleans, leading to a weak and ineffective government. In Louisville, a strong civil society reinforced an atmosphere of relative racial harmony, allowing a more effective government to take root.

To recast this argument in terms of structuration theory, it appears that there are at least two levels of structuration occurring. The practices of citizens lead to specific types of social capital forming in communities. The types of social capital that emerge either empower or constrain government actors as they choose from available options in their daily life. The practices of government actors in turn reinforce, or help reproduce, the types of social capital present in the community. This is the recursive relationship of which Giddens speaks,

whereby actors are constrained by structure, but also must reproduce structure, and therefore have the capability to transform structure.

It is reasonable to ask what regime analysis offers that is not present in social capital theory. Indeed, it would probably be possible to arrive at similar conclusions based on social capital theory, without citing regime analysis. But regime analysis helps to put a stronger focus on relationships among elites in different institutions. The social capital theory cited earlier includes references to several different types of social capital. Bonding social capital occurs within tightly defined groups, of which the strong ties in an Italian neighborhood described by Grannovetter (1973) are an example. Bridging social capital occurs between groups; we might imagine social networks between an Irish neighborhood and an Italian neighborhood, for example. Linking social capital occurs between elites and non-elites, of which an example might be a small neighborhood organization asking a large corporation to help fund a beautification program.

A regime might simply be considered a different type of social capital, one that exists between elites in different organizations. Regime analysis, emerging out of a political science literature provides a language that is well-suited to describing relationships within a governing coalition. Chapter 6 suggests that the nature of the regime in a place is affected by the other types of social capital that exists within that place, and that these other forms of social capital are influenced by the socio-economic characteristics of individuals residing in the place. In Louisville, the black swing vote made representatives of the African American community regular members of the governing coalition, and this helped create a long-lived regime. Regime stability was enhanced by the presence of a broad-based governing coalition in Louisville, and it persisted across changes in Mayoral administrations. In New Orleans,

uni-racial electoral coalitions succeeded one another, never achieving a capacity to be considered a regime. Since regime analysis describes the relationships that create adaptive capacity at the group level, combining regime analysis and other social capital theory may be a useful way of conceptualizing the link between individual and group vulnerability.

The greatest weakness in this, and in structuration theory more generally, is that Giddens and his followers have never adequately explained *when* actors are able to transform structures through their practices. Although structuration theory offers a vague hope that individual actions can lead to a better world, the implications for praxis are fuzzy. This leads naturally to a discussion of whether any particular policy options flow from this theorizing.

7.2 Policy Implications

An implication of this research is that the federal government has a legitimate interest in the nature of governing coalitions. In a federal system, the success of a national program often depends on partnerships between levels of government (Mitchell 2006). It is therefore in the interest of the federal government to have governing coalitions in communities that are capable of being effective partners in policy implementation. Moreover, federal intervention is often necessary when local governments fail to perform their duties. Municipal governments that cannot perform their core functions thus represent potential costs to American taxpayers.

In the context of a changing climate, municipalities with low adaptive capacity represent a national vulnerability. As national policies to promote successful adaptation are formulated, attention should be given to communities with weak and ineffective governing coalitions.

These communities would constitute the weak link in a national adaptation program. Thus, building capacity at the community level is integral to a national adaptation strategy.

Previous literature suggests that federal policies can affect the nature of regimes, and the nature of social capital, in communities. Mossberger and Stoker (2001) argue from regime theory that federal programs in the late 1960s and early 1970s had an impact on governing coalitions by making resources available for large-scale economic development projects. Szreter, in his critique of social capital theory, argues that federal policies of disinvestment in poor communities and erosion of a social safety net destroyed bridging and linking social capital in low income communities, and had the effect of promoting an inward-looking and often dysfunctional form of bonding social capital. Thus, there is some indication in prior literature that federal policy can affect governing coalitions and social capital in communities.

If the federal government has an interest in building social capital and inclusive governing coalitions in communities, then what set of policies could serve this goal? I would argue that additional funding for programs such as Community Development Block Grants (CDBG) would further these goals. CDBG makes money available to community based organizations (CBOs) in low-income neighborhoods. Most money is used for the development of affordable housing, although other social services are also promoted.

Channeling money through CBOs builds social capital in several ways. First, using public funds to address needs identified by a community can help relieve some of the social distress in low-income neighborhoods, reducing cynicism and building confidence that community improvement can occur. Second, as suggested by regime theory, actors with resources are more attractive coalition partners. Channeling resources through CBOs, then, gives

governing coalitions more of an incentive to include CBOs a role in governance. Requiring a real partnership between CBOs and municipalities, as a condition for receiving federal funds, helps to give representatives of low-income individuals a seat at the table in the governance of the community.

CDBG funding, while never extravagant, has been cut significantly in the last seven years. In addition to strengthening support for CDBG, federal policies could promote social capital and inclusiveness by finding other mechanisms for requiring partnerships between CBOs and local governing coalitions. One example might be regulatory changes requiring Metropolitan Planning Organizations (MPOs) to form effective partnerships with CBOs in order to satisfy environmental justice requirements related to federal transportation funding. As federal attention turns to the topic of climate change adaptation, these requirements could be built into legislation, making strong communities integral to the national adaptation strategy.

There are policy implications at the local level as well. If inclusive cities have the greatest capacity to adapt to a changing environment, then it is in the interests of all members of a community to invest in the most vulnerable members of the community. This suggests a platform including the following elements: ensuring excellent public services in low income communities, actively seeking out representatives of low-income neighborhoods for meaningful inclusion in long-range planning, and devoting resources to strengthening the capacity of CBOs.

It would be naive to expect this sort of behavior to spontaneously occur in many communities around the nation. As a practical matter, building more inclusive communities requires, to borrow a Marxist term, struggle. Inclusiveness in Louisville was not built overnight. It was formed through decades of struggle by marginalized groups, from

immigrants to labor to African-Americans. Similarly, the hard work of building social capital and creating inclusive governing coalitions requires actors in low-income communities to do the hard work of building social capital and demanding representation in governance.

This points to the importance of community organizing as a profession, as a distinct field within urban planning, and as a tactic for adapting to environmental challenges. Philanthropic organizations interesting in enhancing adaptive capacity at the community level might consider funding groups that send organizers into church basements and community centers. Bringing marginalized individuals together to exert pressure on a governing coalition is a long-term strategy, but one that may result in more responsive governance. More practical research is needed on community organizing techniques that build the right kinds of social capital, strengthen civil society, and bring about more effective and accountable governments. This type of research would have value in practical literature on climate change adaptation as well as in broader social theory.

7.3 Further Questions

Beyond the broad theoretical issues enumerated above, there are several ways that the empirical evidence presented in this dissertation could be strengthened and refined by additional research.

First, an additional influence that may affect participation in programs such as CRS is whether neighboring communities participate. Indeed, the social network between officials in nearby municipalities may be an important type of social capital that affects the adaptive

capacity of communities. Additional research on the "neighbor effect" would be a valuable addition to literature on adaptive capacity.

Second, many more cases are needed in order to begin generalizing about reasons that municipalities exhibit differing levels of adaptive capacity. This would also help tease out potentially confounding variables such as the size of a city, the region in which a city is located, and coastal vs. inland patterns.

Third, additional work needs to be done to assess the generalizability of these findings. At the community level, potential challenges associated with climate change include water shortages, public health issues and emergency operations, among other impacts. It would be useful to perform quantitative analysis on forms of adaptation related to these issues. For example, among communities confronted with drought, is SES related to the ability to create effective water conservation policies, or to invest in infrastructure to increase reservoir capacity? For cities that face extreme heat, are socio-economic aggregates associated with programs aimed at providing heat relief to vulnerable populations? To answer these questions, a researcher would need to identify likely impacts associated with climate change, identify effective adaptations to these impacts, and then assess factors that influence the adoption of these adaptations in communities already affected. An attempt to replicate the methods used in this dissertation to study the adoption of other forms of adaptation would be a contribution to the literature.

While the focus of this work has been adaptation to environmental challenges, it would also be interesting to study other types of adaptation. For example, cities throughout the United States have been forced to adapt to new conditions created by deindustrialization and

new technologies. It is logical to hypothesize that adaptive capacity in other areas is associated with aggregate measures of SES, but this hypothesis needs to be tested.

Fourth, this research addressed only communities in the United States. It would be interesting to see if the findings are generalizable to governing coalitions in other industrial nations, or even in post-Colonial states.

Fifth, I hope that others will conduct research on the CRS program, and on participation in the program. There are many aspects of this program that warrant additional focus. It would be interesting to look cities with significant flooding risk that do not participate in the program, or at cities with very high risk that participate only at lower levels. Determining reasons that cities do not participate could be an important step in isolating factors that detract from adaptive capacity. A related approach would be to look at cities that formerly participated, but whose CRS status is now rescinded. A scholar would do well to determine what happened in these lapsed cities.

On the other end of the performance scale, it would be very useful to conduct both qualitative and quantitative studies looking at the top performers in the CRS program. At this writing, there are fewer than 30 cities that participate at Level 5 or greater. It would be interesting to discover factors that these high-performance cities share, and to determine whether these cities exhibit high levels of adaptive capacity in other areas.

Some potentially useful data sources are the reporting and verification documents issued by the Insurance Services Organization (ISO). The ISO sends a letter to each participating city explaining how many points are awarded in each of the dozens of categories in which participating cities can accrue credits. A researcher who cultivated a relationship with the

ISO, or with individual ISO representatives, could have the opportunity to explore a very rich data source.

Finally, and perhaps most importantly, it would be very useful to find consistent indicators of social capital at the municipal level. It would be difficult to develop such a data set, and probably impossible to develop a data set that includes all municipalities in the country. Still, finding good indicators of municipal social capital--ideally including indicators of different types of social capital--would be the best way to assess the validity of the theoretical notions advanced in this dissertation.

Researchers interested in pursuing this avenue of data collection might use publicly available lists to quantify the number of civic organizations in different communities. Possible sources for such an exercise would be lists of non-profit organizations maintained by Secretaries of State, online non-profit databases such as Guidestar, and even telephone directories. Analyzing a sample of the IRS-990 forms submitted by civic organizations in different locales could yield an assessment of the capacity and strength of civil society in a municipality. Another possible avenue would be to use the Federal Register to measure the number of federal grants, and the dollar amounts, that go to non-profit organizations in different cities. This might be a useful measure of the strength of civil society in different communities.

A related exercise would be to compile indicators of polarization at the municipal level. Possible indicators might include race-specific data on high school dropout rates, and race-specific information on incarceration. Newspaper searches could potentially yield indices to measure the strength of organizations serving minority communities in individual cities. For

example, the number of times that a city's Urban League is mentioned in the major daily newspaper might be an indicator of the strength of community-based organizations.

Much more analysis would need to be done to determine feasible and valid methods of assessing social capital and polarization at the community level. But such a data set would serve many different types of social research in addition to assisting the study of adaptive capacity.

Adaptive capacity, particularly as it relates to climate change, is a fairly new field of study. While significant work has been done, it has thus far been fairly atheoretical. Integrating social theory into the study of adaptive capacity offers the potential to develop richer explanations, generate additional hypotheses, and contribute to a more multi-dimensional research agenda. My hope is that this dissertation will contribute to this effort.

Appendix 4.1: Additional Explanatory Variables

This appendix presents results for models using additional explanatory variables not covered above. I ultimately concluded that the results presented below were of limited value, either because the sample size was too small or because the variables may not be adequate proxies for the concepts that I was trying to measure.

Type of Government: All New Jersey municipalities have one of the following five types of government: Borough, City, Town, Township or Village. These types are defined under New Jersey state law, and differ mainly according to the degree of power delegated to a chief executive (New Jersey State Library, New Jersey League of Municipalities).

In an exploratory data analysis, I attempted to isolate differences in CRS participation with respect to type of municipal government for the 176 cases in my coastal New Jersey data set. Participation rates for the different types of government were as follows:

Appendix Table 4.16: Participation by Municipal Type

	Participants	Non-Participants	Percent Participating
Borough	18	61	22.8
City	8	27	22.9
Town	0	5	0
Township	5	50	9.1
Village	0	2	0
Total	31	145	17.6

To assess whether significant differences exist between the different types of government, I employed the Chi-Squared test, using Yeats's correction for small number of successes. The Chi-Squared table is presented below. Yeats's Chi-Squared, 3.5, is not significant at $p<.05$ for 3 degrees of freedom.

Appendix Table 4.17: Yeats Chi Squared Table

	Expected	Observed	$(\|e-o\|-.5)^2/e$
Borough	14	18	0.875
City	6	8	0.375
Town	1	0	0.25
Township	10	5	2.025
Yeats Chi^2			3.525

If a significant difference in participation rates had been observed between different types of municipal government, then this would have warranted additional investigation into whether the governmental types exhibited different levels of professionalism in municipal government. However, the exploratory use of the Chi-Squared test dissuaded me from pursuing this line of investigation further. Perhaps with a greater sample size, this question could be investigated further.

Electoral Competitiveness and ANJEC Membership

In an effort to test the hypothesis that electoral competitiveness at the local level is conducive to professionalism in government, I examined municipal-level election returns data. In order to compare similar elections across all municipalities in my sample, I selected election returns for the 2000 U.S. Senatorial election. This was an election to fill a seat vacated Frank Lautenberg. In an effort to assess the competitiveness of elections in each municipality, I added an independent variable, ELEC, which represented the percentage of the vote received by the winning Senate candidate for each municipality. A value of 50 in the ELEC field would indicate a very competitive election, while an entry of 80 would indicate a much less competitive election. Model 1 in Table 3 shows that the addition of this variable had no significant effect on any of the models.

I concluded, however, that using election returns for a federal election was not a satisfactory way to assess competitiveness in a municipality. It is possible that a municipality might give a disproportionate number of votes to one party in federal elections, while remaining much more competitive in local elections. Thus, I did not pursue this line of investigation further.

Ideally, the competitiveness hypothesis would be investigated by using data on municipal elections. However, to assess competitiveness on the local level, it would be necessary to control for incumbency, and in cases when the incumbent is running for re-election, to have some way to control for the performance of the incumbent while in office. This would be a good topic for future research.

Another variable that I experimented with was membership in the Association of New Jersey Environmental Commissions (ANJEC). I had thought that this variable might be a good proxy for professionalism in municipal government. Membership in this statewide association, I felt, might give some indication of whether actors in a municipal government place value on the establishment of professional relationships and on the sharing of policy-related information with colleagues. These, it seems, might be related to overall levels of professionalism in government.

Model 2 in Table 3 shows that the ANJEC variable did not significantly affect results in any models. However, I was not convinced that the lack of ANJEC participation was a true measure of the lack of professionalism. There might be other reasons that a community, even one with a high level of commitment to environmental protection, might opt against creating an environmental commission. Thus, I did not pursue this line of investigation further.

Appendix Table 4.18: Probit Models

Dependent Variable: CRS Participation at Level 7

	Model 1		Model 2	
POP	-9.05E-07		-0.000000914	
LOSS	0.0000327	**	0.0000338	**
FAC1_1	0.016761	*	0.0175009	*
FAC2_1	-0.0017581		-0.0032193	
ELEC	-0.0000369			
ANJEC			-0.0021275	
Obs P	0.0568		0.0568182	
Pred P	0.0135		0.0145139	
Pseudo r^2	0.3233		0.3223	

Dependent Variable: CRS Participation at Level 7 or 8

	Model 1		Model 2	
POP	-2.81E-06		-2.44E-06	
LOSS	0.0001308	**	0.0001341	**
FAC1_1	0.079702	**	0.0833267	**
FAC2_1	-0.0259648		-0.0139534	
ELEC	0.0003039			
ANJEC			-0.0338375	
Obs P	0.1534			
Pred P	0.0968			
Pseudo r^2	0.2296			

Dependent Variable: CRS Participation at Any Level

	Model 1		Model 2	
POP	-9.38E-07		-5.56E-07	
LOSS	0.0001874	**	0.0001935	**
FAC1_1	0.0937486	**	0.097008	**
FAC2_1	-0.0433079		-0.0195077	
ELEC	0.0005613		-0.0443305	
ANJEC				
Obs P	0.1761		0.1761	
Pred P	0.1264		0.1275	
Pseudo r^2	0.2342		0.2282	

The lines of investigation described in this appendix neither supported nor refuted the central argument in Chapter 4. The main focus of Chapter 4 was to test the hypothesis that socio-economic status is related to adaptive capacity, as measured by participation in the Community Rating System. The analysis presented in Chapter 4 supported this hypothesis, and the statistical analysis presented in this appendix does not affect this conclusion. However, the fragmentary research presented in this appendix does highlight the need for additional quantitative measures of professionalism in government and competitiveness of politics at the municipal level.

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Principal Occupations and Positions Held

September, 2006 - Present	Manager of Research Services, East-West Gateway Council of Governments, St. Louis, Missouri.
May 2002 - September 2004	Assistant Director, New Jersey Department of Human Services, Division of Family Development.
May 2000 - May 2001	Research Assistant for Professor Clinton Andrews, Rutgers University.
1999-2000	Excellence Fellow, Rutgers University
September, 1992 - August, 1999	Research Analyst, City of St. Louis

Papers and Publications

Posey, John and Charles Kindleberger. 1996. City Governments Go Online. GIS World 9(6) pp. 50-52.

Posey, John. 1996. The St. Louis Community Information Network: A Case Study. URISA 1996 Annual Conference Proceedings, pp. 29-43.

Posey, John. 2002. Book Review: Dealing with Poverty and Inequality. Review of What Government Can Do by Benjamin I. Page and James R. Simmons. Journal of the American Planning Association 68(1), pp. 108-109.

Grammich, Clifford and John Posey. "Faith-Based" Social Services in Rural Areas. Paper presented at the annual meeting of The Midwest Political Science Association, Palmer House Hilton, Chicago, Illinois, April 7, 2005.

(Co-Author.) New Jersey Department of Environmental Protection, Division of Science, Research and Technology. 2003. Final Report of the New Jersey Comparative Risk Project. Available online at http://www.nj.gov/dep/dsr/njcrp/