EVALUATING LOCAL HAZARD MITIGATION PLANNING: QUALITY, PUBLIC PARTICIPATION, AND SOCIAL VULNERABILITY

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**ABSTRACT**

Despite abundant amounts of data and significant advances in communications and engineering technology, global trends in hazard vulnerability and disaster losses continue to rise. Moreover, the most marginalized and disadvantaged members of society bear the brunt of these losses and impacts.

The United States emergency management community has responded to increasing trends in disaster losses by underscoring the importance of hazard mitigation at the local scale. Although the planning literature acknowledges that plan quality is a key factor in determining planning outcomes, and that engaging local community stakeholders in the planning process is critical to creating high-quality mitigation plans, little empirical research has been done to evaluate the nuances of the local hazard mitigation planning process. Moreover, the literature has not evaluated how social vulnerability factors affect mitigation planning processes and plan quality outcomes.

This study examines local hazard mitigation plan quality, models of participatory planning, and social vulnerability in the northern California Bay-Delta region. It applies a mixed methods approach to identify relationships between local social vulnerability, public participation, and plan quality outcomes in 34 communities.

The results of this study show that neither public participation nor social vulnerability was associated with plan quality outcomes in the study region. Additionally,
social vulnerability had no relationship to public participation levels. Planning scale emerged as an important driver of plan quality and single-jurisdiction planning efforts were positively correlated with plan quality outcomes. The case studies provide further insight into these findings and relationships and present a best-practices model for knowledge sharing and decision-making for local hazard mitigation planning.

The form and content of this abstract are approved. I recommend its publication.

Approved: Jeremy Németh
DEDICATION

I dedicate this work to my grandmother, Doris Janes, the strongest and most inspiring woman I know. Her contagious positivity, warm advice, and late-night phone calls made this journey a success.
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CHAPTER I
INTRODUCTION

The Hazards and Disasters Problem

*When coupled with development in high-risk areas, differential vulnerabilities can lead to catastrophic results. [...] What good is a federal response plan when it clearly does not work and does not alleviate the suffering of the most vulnerable within our society? What does it say about the adequacy of preparedness when we know so little about the most disadvantaged within the communities?*

— Moral Hazard, Social Catastrophe (Cutter & Emrich, 2006, 102)

Currently, we are losing the battle for a safe and sustainable society in the United States and throughout the world. Despite abundant amounts of data and significant advances in communications and engineering technology, global trends in hazard vulnerability and disaster losses continue to rise. Some estimates describe a three-fold increase in disaster events over the last thirty years with associated economic damages increasing by a factor of six (sources from EM-DAT, The World Bank, MunichRe; Mileti, 1999; Birkmann, 2006). Moreover, projections based on climate change and current land use and development patterns predict that communities, especially those living in urbanized areas, are expected to experience increased exposure and vulnerability to hazards from floods, storms, landslides, heat waves, droughts and other hazard events over time (Huq, 2007; Bouwer, 2011).

The problem of increasing hazard vulnerability is more than strictly an economic concern. It is more than an issue of sustainable infrastructure or natural security. It is, at its core, an issue of social justice. In their study of the legacy of Hurricane Katrina, Cutter and Emrich (2006) observed that the disaster vulnerability of the U.S. population is
unevenly distributed among social groups and between places. They describe a phenomenon in which some communities suffer higher risks of hazard impacts than others due to the characteristics of the people who live and work within their boundaries.

Cutter and Emrich (2006) describe Hurricane Katrina as an example of a “social catastrophe.” Not only were socially and economically marginalized residents of New Orleans disproportionately affected by the disaster, but the ability of people to recover and rebuild their lives also varied widely depending on their economic status, race, gender, age and education level (Phillips et al., 2009). Ultimately, the disaster event created by the storm was driven by deep-seated moral hazards. It is this unjust reality that motivates and frames my dissertation research.

The challenge is clear: a different approach to disaster management and planning is necessary if we hope to remedy the crisis of differential local and regional hazard impacts. In the context of disasters, communities are only as strong as their weakest link. Therefore, in order to protect those who are most vulnerable, and to bolster local resilience and adaptive capacity, we must shift away from a one-size-fits-all approach to planning towards one that can be tailored to fit the unique social contexts of communities.

**Local Planning for Disaster Vulnerability Reduction**

The United States emergency management community has responded to increasing trends in disaster losses by underscoring the importance of coupling disaster preparedness with hazard mitigation planning. The passing of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121) in 1988 represented a
sea change in national emergency management priorities when it established pre-disaster hazard mitigation planning as the key mechanism for combating increasing disaster losses in the United States (Robert T. Stafford Disaster Relief and Emergency Act, P.L. 100-707, 42 U.S. Code sec. 5121 et seq.).

The fundamental principle behind hazard mitigation is that most of the damage and loss caused by hazard events can be prevented. Although most hazard events cannot be prevented from occurring altogether, their disastrous impacts on people, property, and infrastructure can be diminished if proactive measures are taken to reduce risk and local vulnerability (Comfort et al., 1999; White, et al. 2001; Godschalk, 2003). Hazard mitigation planning involves pre-event hazard identification, risk and vulnerability analysis, and the creation of feasible mitigation strategies to reduce or eliminate hazard risks. Together, these efforts contribute to reduced vulnerability of infrastructure and people to the impacts of hazards and helps reduce physical, economic and social losses (Nelson & French, 2002; Comfort et al., 1999; White, et al. 2001; Godschalk, 2003; Wisner et al., 2004).

The adoption of hazard mitigation planning as a pillar of the United States’ emergency management strategy was coupled with a turn towards state and local-level emergency management activity. Specifically, with the creation of FEMA’s Project Impact in 1997, and the passage of the Disaster Mitigation Act in 2000 (DMA 2000), there is now a strong emphasis on loss and risk reduction through state, county, and municipal hazard mitigation planning efforts.

Since the passage of DMA 2000, researchers have been working to identify the impacts of local hazard mitigation planning efforts on levels of disaster risks, loss, and
vulnerability. Although measuring prevention is a great challenge, empirical research has shown that higher quality hazard mitigation plans have greater outcomes in terms of reduced vulnerability to hazards and building human resilience to disaster impacts (Burby et al., 1999; Brody, 2003; Godschalk et al., 2009; Beatley, 2009; Peacock et al., 2008). Additionally, the inclusion of local knowledge in hazard mitigation plans has been shown to contribute positively to plan quality (Burby et al., 1999; Brody, 2003; Burby, 2001, 2003; Godschalk & Brody, 2003).

To be sure, the creation of high quality plans is not the end point in the overarching goal of reduced social vulnerability, hazard impacts and loss. Rather, high quality hazard mitigations plans are an important intermediary step of the disaster risk reduction process of all communities. Not only has plan quality been shown to predict implementation outcomes, it can be used as a parameter for assessing public engagement and the incorporation of local community knowledge into decision making and policy. Ultimately, we are interested in an extension of these outcomes, including social vulnerability reduction. One of the key goals of this study is to contribute to an understanding of how mitigation planning can play a role in reducing impacts to disasters in socially vulnerable communities.

Planners and emergency managers have started to acknowledge that plan quality is a critical issue and that engaging community stakeholders in the planning process is key for creating usable, relevant, high-quality mitigation plans. If planners and emergency managers intend to create high-quality plans that guide local government behavior towards reduced vulnerability and increased resilience to disaster impacts, a key question emerges: How is information about local vulnerability incorporated into
decision-making processes? How can planning be improved to encourage the integration of hazard mitigation planning with local land use policy and community priorities?

While DMA 2000 and Project Impact both emphasize increased community participation in the local hazard mitigation planning process, guidelines and standards for collecting community-derived information, and strategies for incorporating this information into planning and decision-making, are nearly nonexistent. There is great need for a scalable planning approach that planners and communities can use as a tool to create contextual, implementable local hazard mitigation plans. This research study contributes to the planning literature by explaining what this approach to planning might look like.

Research Questions

This study examines plan quality, models of participatory planning and social vulnerability in the context of hazard mitigation planning in the Northern California Bay-Delta region. California state legislation has shown tremendous support for local participatory action in hazard mitigation planning. As an example of a state that has taken a highly progressive, proactive stance towards local hazard mitigation planning, two research questions can be raised about the effectiveness of California’s approach:

Research Question #1

What is the quality of local hazard mitigation plans created in the Northern California Bay-Delta region and to what extent has the public participated in the planning process?
Aim 1: To identify social vulnerability data in plans and incorporate that data into plan quality assessment metrics

Aim 2: To assess the involvement of community stakeholders during the planning process

Aim 3: To identify the participatory planning models employed by each city during the local hazard mitigation planning process

Research Question #2

How do community characteristics and levels of public participation affect mitigation plan quality outcomes?

Aim 4: To identify key relationships between local community characteristics (including population size, wealth, diversity, social vulnerability characteristics) and local plan quality scores

Aim 5: To analyze how community characteristics affect levels of public participation in local hazard mitigation planning

Aim 6: To evaluate how public participation in planning affects local hazard mitigation plan quality

This study follows a mixed-methods approach, consisting of quantitative plan quality evaluation and the qualitative analysis of in-depth interviews. It evaluates how different approaches to public participation affect the content and quality of local hazard mitigation plans from 34 California cities and expands upon earlier work in the planning and disaster literature by refining plan quality measures to include social vulnerability factors.
Research Impacts

Currently, federal and state efforts to reduce hazard vulnerability by developing high quality, locally relevant hazard mitigation plans continue to fall short (Battista & Baas, 2004; Schwab, 2011; Stevens et al., 2010). A fundamental aim of this research study is to contribute to improved hazard mitigation planning outcomes (including increased project implementation and reduced local social vulnerability) by examining the relationship between models of participatory planning, local community characteristics and hazard mitigation plan quality.

Relative to the disaster literature, scholarship related to participatory planning has a long and rich history. In the past, empirical studies have analyzed barriers and drivers to community participation in planning, the relationships between the participation of specific stakeholders and plan quality, and the plan implementation outcomes associated with participatory approaches to planning. Until now, however, the planning literature has not examined the relationships between social vulnerability to disasters, public participation and hazard mitigation plan quality. Participatory planning is no cure-all for disaster risk. However, a critical analysis of participatory planning processes is necessary in order to identify shortcomings and best practices and to strategically allocate local resources in order to successfully and efficiently decrease social vulnerability to hazards and disasters.
CHAPTER II
LITERATURE REVIEW

Introduction

The overarching research questions that motivate this study are framed by the body of literature on social vulnerability, hazard mitigation and participatory planning. Chapter two covers areas of consensus and dispute in these literatures, and evaluates the nature and quality of support for various contentions in the discussion concerning public participation and improved planning outcomes.

To begin, our review of the hazards and disasters literature highlights key factors that influence mitigation plan quality outcomes, specifically those outcomes associated with local vulnerability reduction and disaster resilience. Later, our exploration of collaborative planning theory and practice offers a framework by which to evaluate hazard mitigation planning and the influences that participatory approaches have on mitigation plan quality and implementation outcomes. Ultimately, this chapter provides a conceptual framework by which local hazard mitigation planning can be evaluated in a new way, one that contributes to significant new understandings of the potential for improved planning practice to contribute to reduced local social vulnerability to hazards and improved local resilience.

Hazards, Disasters, and Vulnerability

2008 marked the first time in human history when urban centers became home to the majority of the world’s people, economic activity, and physical infrastructure. Currently, more than half of the world’s population lives in urban areas (United Nations,
2008). We are living in a unique time of rapid urban development in which high levels of complexity characterize broad social-environmental challenges. It is increasingly clear that current development and planning strategies are producing unsustainable outcomes that have contributed to significant increases in vulnerability to hazards as well as reductions in local, regional, and national quality of life.

An example of the alarming impacts of this development profile is the dramatically increasing trend in international losses from disasters. Not only is the phenomenon a function of increased development in high-risk places, but also of increasing levels of social and physical vulnerability within communities. Increased vulnerability puts communities on trajectories towards greater risk of catastrophic failure or damage in the event of a disaster or shock (Kasperson at al., 1995; UNDP, 2004; Pelling, 1997). Moreover, in particularly vulnerable systems even small perturbations may lead to collapse.

Current mitigation practices often aim to maintain the status quo within communities. However, this approach to planning tends to perpetuate the disaster-damage cycle rather than addressing (and remedying) the root causes of hazard losses. Although efforts to minimize the negative physical impacts of hazards are important, it is equally important that communities implement ongoing planning strategies that take a comprehensive, holistic approach to emergency management by including political, social, and economic factors in their development and mitigation plans. To become truly sustainable in the changing global environment, communities must address social vulnerability as a root cause of hazard losses. This, however, may demand significant changes in current mitigation planning practices as well as in the structure of society.
Definitions of Terms

The rapidly growing body of literature on hazard mitigation planning features a wide, and sometimes confusing, array of terms. Because the study of human and environmental vulnerability to climate change and hazard events is necessarily interdisciplinary, sometimes the same term takes on a different meaning when used by different authors in different contexts. As a result, relationships between terms are often unclear.

In this study the term hazard describes a potentially damaging physical event, phenomena, and/or human activity, which may cause loss of life, injury, property damage, social economic disruption or environmental degradation (UN/ISDR, 2009). Hazards can be characterized as slow-onset events (i.e. droughts or long term temperature change) or rapid-onset events (i.e. floods, landslides or earthquakes). When hazards are described in the context of this study they are described by their physical characteristics.

The term disaster incorporates the human elements of a hazard event. As defined by the International Strategy for Disaster Reduction, disasters are serious disruptions of the functioning of a community or a society causing widespread human, material, economic, or environmental losses, which exceed the ability of the affected community or society to cope by using its own resources (UN/ISDR, 2009). Disasters are triggered by hazard events and are influenced by the properties of the human systems that are exposed to and affected by the hazard.

Risk is an important term in the context of vulnerability assessment. It is a fundamental component of an equation that has been used to determine the likelihood of occurrence (or probability) of a hazard event (Cutter, 1996). Risk is the result of
interactions between a hazard and the vulnerable conditions of a community, place, or individual. Below, the commonly used risk equation describes the relationship between risk, hazards, and vulnerability (Wisner et al., 2004):

\[ \text{Risk} = \text{Hazard} \times \text{Vulnerability} \]

Researchers in the hazards field often focus on the concept of risk assessment, while social scientists and climate change researchers often prefer to talk in terms of \textit{vulnerability} (Downing et al., 2001; Allen, 2003; Brooks, 2003). In general, vulnerability means the potential for loss. Often times, however, social scientists and climate change researchers mean different things when they speak about vulnerability. Generally, definitions of vulnerability can be separated into two categories. One category defines vulnerability in terms of the amount of potential damage caused to a system by a specific hazard (Jones & Boer, 2003). In the global environmental change literature, for example, vulnerability is most often conceptualized as the likelihood of occurrence of impacts from weather and climate related events (Nicholls et al., 1999; Brooks, 2003).

The other category defines vulnerability as an inherent characteristic of a system that changes continuously over time and exists before the system encounters a hazard event (Allen, 2003; Cutter, 1993). For example, social scientists tend to describe vulnerability as a representation of the social-economic factors that determine the ability of communities and individuals to cope with stress or change (Allen, 2003; Brooks, 2003).

Over time, the concept of vulnerability has been borrowed, recycled, and reused by numerous disciplines and has taken on a number of definitions and applications. It is not within the scope of this dissertation to review them all, however two distinct concepts
of vulnerability are clearly evidenced in the hazards and disasters literature: *biophysical vulnerability* and *social vulnerability*. Although these concepts are connected, they frame vulnerability reduction discussions in very different ways and it is important to understand the nuances between them.

The IPCC Third Assessment Report defines vulnerability as a measure of the nature of the physical hazard to which the community is exposed, the likelihood of occurrence, and the degree of human exposure to the impacts of the hazard (or the system’s *sensitivity*) (IPCC, 2001a). This three-tiered, aggregated measure of vulnerability – a function of hazard, exposure and sensitivity – is sometimes referred to as *physical* or *biophysical vulnerability*. Ultimately, biophysical vulnerability assessments are concerned with the outcomes of hazard events (the amount of damage sustained by a system from a hazard), rather than with indicators of the state of the system before the event.

A second, distinct conceptual stream describes vulnerability as a state, or as an inherent characteristic of a system that exists before it encounters a hazard event (Allen, 2003; Cutter, 1993). This view developed from a body of social science research related to understanding the structural factors that make human societies more or less susceptible to damage from hazard events (Mileti, 1999; White & Haas, 1975; Kasterson et al., 2003; Cutter et al., 2003). The concept (as it relates to strictly human systems) is called “social vulnerability” (Cutter et al., 2003; Adger, 1999; Adger & Kelly, 1999). One of the significant lessons from this body of research is that social vulnerability is a unique property of a system. It exists before a hazard event and changes continuously over time.

Social vulnerability is the product of social inequalities. Its theoretical origins lie
in the quality of life and livability studies in the social and behavioral sciences during the 1950s and 1960s. The 1960s and early 1970s witnessed a surge in federal government interest in the identification and quantification of social well-being indicators (Cutter & Emrich, 2006; U.S. Department of Health, Education, and Welfare, 1969; U.S. Office of Management and Budget, 1973). Initially, this body of research tried to understand specific characteristics of places that make them more or less desirable and suitable places to live.

Increasingly, empirical research began to delve into the social attributes of people and places as a way of understanding and predicting human behavior when faced with problems of social, health and environmental nature (Cutter & Emrich, 2006; Maloney, 1973; Smith, 1973; Berry, 1977). Preliminary research in this area set the stage for the interdisciplinary trends in inquiry that are currently found in the vulnerability science literature (Cutter, 2003). Moreover, studies of this nature have made it clear that differential social vulnerability is an important social justice concern.

**Measuring Social Vulnerability**

A number of attempts have been made to measure and quantify social vulnerability, including national-scale hazards and disaster indicator studies that include social characteristics in their multi-hazard exposure models. Others have included social vulnerability indicators in their evaluations of social-ecological systems and different scales, including U.S. watersheds (Hurd et al., 1999), counties within the U.S. Great Plains (Polsky, 2004), and states across the U.S. (Cutter et al., 2003). The quantification of social vulnerability has also become an important focus of field research and
vulnerability mapping projects concerned with identifying the most vulnerable members of society and examining variations in vulnerability over time and between or within geographic areas (Cutter, 2003; Cutter et al., 2008; Borden et al., 2007; Piegorsh et al., 2007).

As foundations for research on vulnerability and risk, three conceptual models have been particularly significant: the Risk-Hazard model (RH), the Pressure and Release (PAR) model, and the Hazards of Place model. The RH model looks at hazard impacts as a function of exposure to a hazard event and the sensitivity of the exposed system (Warrick, 1980; Riebsame, 1991; Kates, 1985). Most quantitative system evaluations using this model have worked forward, from the hazard to their impacts, and have evaluated multiple impacts of a single perturbation (Warrick, 1980; Riebsame, 1991; Kates et al., 1985).

Continued vulnerability research has revealed the RH model’s shortcomings including its failure to incorporate the ways in which affected systems can magnify or ease the impacts of a hazard event (Kaspersen et al., 1988; Turner et al., 2003). Moreover, the model does not identify the ways in which different components of a system create variations in the degree and nature of impacts. Finally, the model does not include the role of social or economic institutions in affecting exposures or impacts (Wisner et al., 2004).

These criticisms led to the development of the Pressure and Release model (PAR). In this model, risk is generated at the intersection of two opposing forces: the hazard event and the vulnerability of the exposed system (Wisner et al., 2004). The PAR model focuses on dynamic social conditions of exposure (or pressures) as the root causes
of vulnerability. These pressures can be traced back to distant processes and factors, creating a causal chain of vulnerability (Wisner et al., 2004). The release component of the model has to do with vulnerability reduction activity (Wisner et al., 2004), and, like a breaking wishbone, the moment at which the accumulated pressure within the system is released and a disaster occurs.

According to the PAR model, in order to mitigate the vulnerabilities that cause disasters, the entire causal chain must be addressed, all the way back to the root causes. According to the PAR, focusing solely on the triggers of the hazard event or on the physical unsafe conditions of vulnerability is ineffective at reducing the vulnerability of the system. Although it explicitly emphasizes the importance of vulnerability reduction in disaster management, the PAR model is insufficiently comprehensive for the broader concerns of sustainable development. For one, it does not address the coupled human-environment system or consider the vulnerability of biophysical subsystems (Kasperson et al., 2003). Additionally, the model offers little insight into the structure of the hazard’s causal sequence, including various scales of interactions, and it tends to underemphasize feedbacks beyond the immediate system of analysis (Kates et al., 1985; Turner et al., 2003).

The Hazards of Place model illustrates how the interaction between hazards and social vulnerability produces outcomes in terms of physical or economic damage or loss of human life. It has been an attractive model to researchers because it integrates two perspectives on vulnerability – the biophysical and the social (Messner & Meyer, 2005). Both the RH and PAR models of vulnerability underscore how different communities have different capacities, sensitivities, and exposures to hazards and shocks. Within
human systems these characteristics are closely linked to social factors including power, basic human rights, and access to resources (Wisner et al., 2004; Sen, 2003). As it became increasingly clear that focusing only on physical hazards and exposure was insufficient for understanding the impacts of hazards on human systems, focused efforts began to develop metrics for social vulnerability (Mileti, 1999; White & Haas, 1975; Kasperson et al., 2003).

In the Hazards of Place model (Figure 1), risk interacts with mitigation activity to produce a level of hazard potential. Eventually, this hazard potential is either moderated or enhanced through geographic filters, such as the physical proximity to the hazard and the social fabric of the place. In this model, biophysical and social vulnerability interact to produce an overall level of place vulnerability (Cutter et al., 2003).

![Figure 1: The Hazards of Place Model](image)

Social vulnerability measures population sensitivity to hazards as well as the ability of a population to respond and recover from hazard impacts. Because it is a
complex, multidimensional concept, researchers have aggregated a collection of variables
to help identify, capture, and quantify it. A large body of empirical evidence from field-
based research has contributed to more robust understandings of the characteristics that
make some people and social groups more sensitive to hazard impacts than others, as
well as what makes them better able to respond and recover from shocks (Cutter &
Emrich, 2006; NRC, 2006; Heinz Center, 2002).

Based on the Hazards of Place model, Cutter et al. (2003) developed an index for
the purpose of distilling out the driving factors of social vulnerability. Cutter and her
colleagues have conducted a suite of research studies quantifying the vulnerability of
people and places to natural hazards at different scales. In their 2003 paper, Social
vulnerability to environmental hazards, Cutter et al. (2003) used county-level
socioeconomic and demographic data to create an index of social vulnerability to
environmental hazards. They named their social vulnerability quantification tool the
Social Vulnerability Index (also known as SOVI).

Based on the results of myriad SOVI and cultural competency studies, socio-
economic status, gender, race and ethnicity are the most common characteristics defining
socially vulnerable populations. The age profile (children and the elderly), percentage of
limited language speakers, and housing tenure (renters) also play significant roles in the
ability of populations to absorb impacts, respond and recover in the event of a disaster
(Pastor et al., 2006; Andrusi, Siddiqui & Ganter, 2007). To illustrate this point, consider
for a moment why people with limited language skills are more vulnerable in the event of
a disaster. Previous studies have shown that the inability to understand evacuation
warnings or preparedness bulletins influences an individual’s or community’s ability to
comply with safety measures. Additionally, the inability to communicate special needs to emergency responders or law enforcement can influence their ability and willingness to receive adequate health care or emergency supplies. Limited language ability also affects an individual’s or community’s ability to communicate their risks and vulnerabilities to planners and emergency managers who organize pre-disaster mitigation efforts. As a result, communities with populations made up of greater proportions of individuals with limited language have a higher social vulnerability to hazard impacts and it will likely take them longer to recover from a hazard event (Kreisberg et al., 2011; Pastor et al., 2006).

More recent studies indicate that there are spatial and temporal patterns in social vulnerability across the United States. In their 2008 paper, Temporal and spatial changes in social vulnerability to natural hazards, Cutter et al. (2008) found that the factors that consistently increase social vulnerability at the county scale for all time periods are urban density, race/ethnicity, and socioeconomic status. At the national scale, trends show a steady decrease in social vulnerability. However, there exists significant regional variability, with many counties showing clear increases in social vulnerability over the past fifty years (Cutter et al., 2008).

Although social vulnerability is not a function of hazard severity or probability of occurrence, it is, to a certain extent, hazard specific. In other words, when thinking about social vulnerability we must ask the question: vulnerability of whom to what? This is because certain properties of human systems make them more or less vulnerable to certain types of hazards. For example, quality of housing is an important determinant of a
community’s vulnerability to an earthquake or a windstorm. However, it is less likely to influence the community’s vulnerability to drought.

To summarize, biophysical vulnerability depends on the severity and probability of a given hazard event, whereas social vulnerability does not. Biophysical vulnerability is conceptualized in terms of outcomes (damages from the hazard event), whereas social vulnerability exists independently of a hazard event. In this dissertation, social vulnerability encompasses all of the system properties that mediate the outcome of the hazard event and is independent of the hazards to which it is exposed. This may include environmental variables and measures of exposure because exposure and the state of the environment in which a community lives and works are largely socially determined (Brooks, 2003).

Increasingly, social vulnerability has been cited by researchers, emergency managers and policy makers as an important element of hazard risk in both urban and rural settings. As a result, increased attention is being turned towards social vulnerability during policy making and development planning. While using data from previous disaster events can identify physical vulnerability relatively easily, the social aspects of hazard vulnerability are difficult to capture due to their complexity and spatial and temporal variability. Despite the progress that has been made with respect to social vulnerability research and variable identification, there is no agreed upon approach or index for quantifying it. As a result, incorporating the concept into policy remains a great challenge.
Building Resilience into Emergency Management

Resilience is another term that continues to emerge more frequently in the disasters and global environmental change discourse. A concept traditionally grounded in ecology and systems theory, resilience has been adopted and modified by a diversity of disciplines, including emergency management. How communities are affected by and recover from unexpected shocks and hazard events can be conceptualized in terms of their resilience. More specifically, a disaster resilient community is one that can withstand and absorb the impacts of extreme disturbances and maintain core functions, often times after assuming an altered form (Innes & Booher, 2010; Berkes et al., 2003).

Although they are closely related concepts, it is important to distinguish between disaster resilience and social-ecological resilience. Born out of systems theory, the concept of social-ecological system (SES) resilience describes to what extent the relationships between social and ecological processes can be disturbed before they experience fundamental changes in identity, structure and/or function (Holling, 1973; Alberti et al., 2003). A deeper understanding of social-ecological systems has shown that not only are resilient systems more able to be flexible in the face of unpredictability and change, but they are also better able to take advantage of future opportunities afforded by change (Holling, 1937; Holling et al., 1995; Alberti et al., 2003).

Early perspectives on ecological and social system dynamics were highly linear. Natural environments were conceptualized as inherently stable and infinitely resilient. Moreover, it was believed that if human stressors were removed, nature would repair itself and return to a state of perfect equilibrium (Holling, 1961; Lewontin, 1969; Rosenzweig, 1971; May, 1972). Ultimately, research on interacting populations (e.g.
predators and prey) and their responses in relation to ecological stability theory led to the emergence of a theory of multiple domains of stability in natural systems (Holling, 1961; Lewontin, 1969; Rosenzweig, 1971; May, 1972). This was the beginning of resilience thinking.

Scholarship on social-ecological system resilience originated in the 1960s and early 1970s from a stream of ecology in which scholars were examining ecosystem behavior in the face of shocks and environmental change. The social-ecological system resilience framework includes humans, as well as environmental factors, as agents of ecosystem change. Traditionally, ecological theory excluded social institutions from the study of ecosystem dynamics and treated human actions as external to the system. As a consequence, the interactions between ecological processes and social dynamics were rarely taken into account in science, policy, or decision-making.

Social-ecological system resilience represents a shift in thinking about unpredictability, as well as in the meaning of equilibrium within systems. In his seminal paper on resilience, *Resilience and stability of ecological systems*, C.S. “Buzz” Holling (1973) wrote that social-ecological system resilience is based on non-equilibrium dynamics and that the concept of equilibrium is poorly suited to explain the behavior of systems that are not currently at equilibrium. He argues that because the concept of equilibrium represents a static state, it is incapable of providing insight into the behavior of systems that are variable or transitional (Holling, 1973).

From the social-ecological perspective, resilience determines the persistence of the relationships within systems and measures the ability of a system to absorb shocks without losing its capacity to function in its current state of existence (Holling, 1973,
Holling (1973) recognized early on that complex adaptive systems are not infinitely resilient. Rather, he suggested that they require adaptive management in order to persist. Adaptive management processes have been characterized by learning-by-doing, where plans and policies are “experiments” from which communities and social systems can learn and share knowledge (Walters, 1986; Gunderson, 1999).

Although disaster resilience describes a more reactive, outcome-based concept associated with bouncing back and recovering quickly after a hazard event, disaster resilience conceptualizes communities as systems of interacting components (i.e. social systems, governance systems, infrastructure, planning entities and ecosystems). Similar to the learning-by-doing approach to resilience building expressed by social ecological resilience theory (Walters, 1986; Gunderson, 1999), communities can increase their resilience to disasters through adaptive management activity including knowledge sharing, learning from past experiences, and creating a common language between different systems actors and decision makers (Paton et al., 2000; Goldstein, 2009; Innes & Booher, 2008; Innes & Booher, 1999; Colten & Sumpter, 2009).

In recent years, expressions such as “disaster-resilient communities” and “building community resilience” have become commonplace in emergency management literature and disaster preparedness and recovery discussions. However, definitions of the term resilience abound, as is highlighted by Table 1.
<table>
<thead>
<tr>
<th>Author</th>
<th>Definition</th>
<th>Disciplinary Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holling, 1973, p.14</td>
<td>A measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables.</td>
<td>Ecological Science</td>
</tr>
<tr>
<td>Walker et al., 2004</td>
<td>Resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes. A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social system has the added capacity of humans to anticipate and plan for the future.</td>
<td>Ecological Science, Social Sciences</td>
</tr>
<tr>
<td>Walker et al., 2006, p.2</td>
<td>The capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity.</td>
<td>Ecological Science</td>
</tr>
<tr>
<td>Adger, 2000, p.347</td>
<td>The ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change.</td>
<td>Social Sciences</td>
</tr>
<tr>
<td>Adger et al., 2005, p.1036</td>
<td>The capacity of social-ecological systems to absorb recurrent disturbances [...] so as to retain essential structures, processes and feedbacks.</td>
<td>Social-Ecological Science</td>
</tr>
<tr>
<td>Department of Homeland Security, TCL, 2007, p.13</td>
<td>Resilience is key [to a determination of vulnerability] since it refers to our coping capacity to absorb events, adapt, and respond to and recover from its effects.</td>
<td>Disaster Management</td>
</tr>
<tr>
<td>Mileti, 1999</td>
<td>Local resiliency with regard to disasters means that a locale is able to withstand an extreme natural event without suffering devastating losses, damage, diminished productivity, or quality of life without a large amount of assistance from outside the community.</td>
<td>Disaster Management</td>
</tr>
<tr>
<td>Paton, Smith &amp; Violanti, 2000</td>
<td>Resilience describes an active process of self-righting, learned resourcefulness and growth – the ability to function psychologically at a level far greater than expected given the individual’s capabilities and previous experiences.</td>
<td>Disaster Management</td>
</tr>
<tr>
<td>United Nations International Strategy for Disaster Reduction (UNISDR, 2010)</td>
<td>The capacity of a system, community or society to resist or to change in order that it may obtain an acceptable level in functioning and structure. This is determined by the degree to which the social system is capable of organizing itself, and the ability to increase its capacity for learning and adaptation, including the capacity to recover from a disaster.</td>
<td>Disaster Management</td>
</tr>
</tbody>
</table>
The increasing use of the word resilience in the context of disasters has been described by some as representative of a new paradigm of disaster response (McEntire et al., 2002). While some scholars consider resilience thinking to be a new paradigm, others describe it as merely an expression that combines other disaster terms (including vulnerability, adaptive capacity, and risk). These scholars believe that, conceptually, disaster resilience does not represent anything new. Citing the occurrence of previous rhetorical shifts created by words like sustainability, they claim “the only new thing is the inclusion of the word ‘resilience’ in the disaster and development discourse” (Manyena, 2006, 435). Despite these critiques, in looking at the foundations and definitions of resilience, and by examining points of overlap between multiple perspectives, it becomes more clear that resilience thinking has great potential to catalyze new and improved ways of planning and governance, particularly in the context of participatory planning and local social vulnerability reduction.

Resilience thinking has emerged as a useful framework for understanding and solving complex urban problems because it can be applied to both the social and physical aspects of communities. Over the past decade, the broad concept of disaster resilience has found both a practical and theoretical home in the disaster risk reduction discourse (Manyena, 2006). For example, a number of international and federal level emergency management, security, and planning entities have identified resilience building as a key priority for guiding policy and sustainable development decisions. A desire to merge disaster risk reduction with urban planning has gained momentum with the publication of reports such as Reducing Disaster Risk: A Challenge to Development (UNDP, 2004) and Disaster Risk Reduction: A Development Concern (DFID, 2005). These publications
underscore how disaster risk accumulates within inappropriate development paths and that increasing disaster losses can be explained largely by the consequent increases in human vulnerability. This phenomenon highlights the necessity of developing alternative frameworks for urban planning practice and decision-making based on robust understandings of the social factors of vulnerability and risk.

In the U.S., resiliency has taken on important meaning in the context of emergency management and homeland security. However, as a process, disaster resilience demands new applications of the risk equation. It necessitates a more holistic approach to vulnerability analysis as it places a new emphasis on the role of people in disasters. By focusing explicitly on resilience, disaster managers are encouraged to consider the social components of vulnerability, including ways in which to enhance community coping capacity and assets rather than simply reducing weaknesses (Manyena, 2006).

\textit{Hazards, Disasters and Sustainability}

Planners have responded in a diversity of ways to growing frustrations with common features of urbanization including sprawl, pollution, inequity, and vulnerability to natural hazards. In the United States, sustainable urban planning strategies have been focused primarily on climate change mitigation measures. By and large, urban centers have relied on improvements to physical infrastructure in response to the impacts of climate change. In addition, climate change mitigation measures such as increased GHG sequestration through wetland creation, decreased GHG emissions from oil and gas industries, and increased investment in renewable energy are gaining greater support at
local and regional levels as a response to climate change and increased vulnerability to storms and floods.

Despite the prominence of efficiency improvements and GHG reduction through engineering advances and policy, urban approaches to “green” development have also included an emphasis on sustainable planning tools such as urban growth boundaries and the LEED-ND rating system. Sustainable development has emerged as a tool for planning practitioners to increase local sustainability on both social and ecological levels. New urbanism, infill development and smart growth strategies are other examples of sustainable planning strategies that have been applied at neighborhood, city, and regional scales. They include the design of compact, high-density neighborhoods for more efficient use of land and transportation; the construction of resource and energy efficient buildings; the “greening” of communities by incorporating trees, parks, and open space. Moreover, by building within existing urban areas, cities conserve their environmental resources, economic systems, and social fabric, while reclaiming marginal and abandoned land (Beatley, 1998; Berke, 2002).

Recently, scores of cities across the U.S. have initiated comprehensive plans and urban development projects with ambitious sustainability goals in mind. However, little attention has being paid to the following question: Is “green” disaster resistant? City planners play an important role in shaping the vulnerability and resilience of urban areas, whether they know it or not. In many cases, projects labeled “green” or sustainable can work against local hazard mitigation and vulnerability reduction efforts (Berke et al., 2009; Stevens et al., 2010).
Communities that are vulnerable to catastrophic damages from hazards are, by definition, unsustainable. A community is unsustainable if it is at risk of losing environmental quality, its economic livelihood, or human lives during a hazard event. As complex systems, cities that are planned with resiliency in mind are capable of withstanding large shocks without sustaining either immediate failure or permanent damage. They are designed and managed to anticipate, absorb, and recover from the impacts of hazards. Moreover, they are built on principles derived from past experience with disasters in urban areas. While resilient communities may bend, they will not break. Despite this logical connection between sustainability and disaster resilience, however, very limited research has been done to unpack the relationship.

Independent of the sustainability revolution, the planning profession has long upheld a development agenda that supports strong economic growth, environmental health and improved quality of life. In his paper *Green Cities, Growing Cities, Just Cities*, Scott Campbell describes the planning discipline as defined by three (arguably divergent) priorities: social justice, economic growth, and environmental protection (Campbell, 1996). Reminiscent of the “three E’s” of sustainable development (environment, economics, and equity), these priorities lie at the historical heart of planning. Conflicts between these priorities define contemporary struggles within human settlements. Campbell (1996) describes the interaction between planners’ three priorities as the *Planner’s Triangle* (Figure 2) with sustainable development situated at the center. The Planner’s Triangle is also conceptualized as a three legged stool (Campbell, 1996).
In this model, Campbell argues that sustainable development cannot be achieved by looking at one leg of the stool at a time. Rather, planners will reach sustainable solutions only by confronting the conflicts between the three points of the triangle and by coming up with resolutions over time. To be sure, the three axes of the planner’s triangle do not interact solely through opposition. They also interact collaboratively (Campbell, 1996). Campbell stresses that in the planning discipline sustainability must be represented as a fine balance between social justice, economic growth, and environmental health. He argues that in an ideal world, planners would strive to achieve a perfect balance between growth, preservation, and equality. In practice, however, professional, political and fiscal constraints often limit the freedom of planners and decision makers to do so (Tobin, 1999).
Hazard Mitigation: Planning, Policy and Practice

The following sections describe the evolution of comprehensive planning practice and how hazard mitigation planning fits into the comprehensive planning framework. The discussion includes a review of the history of hazard mitigation planning in the U.S. and provides the background for a clear understanding of how mitigation planning is used as a tool for the achievement of community-scale vulnerability reduction goals.

The Comprehensive City Plan

In the most general sense, comprehensive plans are long-range physical plans made up of a collection of policies. Typically, the city is the geographic scope of the document. Because the typical time frame of a comprehensive plan is 20-30 years, beyond the scope of current pressing issues, they open up dialogue about future possibilities and challenges. Comprehensive plans focus on social, built environment, and economic infrastructure that make the city work as a physical entity and that affect physical form. Written as a statement of policy rather than a rigid program of specific actions, comprehensive plans are designed to guide urban decision-makers as they make decisions in the future (Black, 1968; So and Getzels, 1988; Innes, 1996).

In 1964, California Bay Area region planner Jack “T.J.” Kent presented a version of the comprehensive city plan that is widely recognized as the strongest representation of the comprehensive planning ideal. In his book, The Urban General Plan, Kent lays out a set of principles and goals for comprehensive planning that planners and scholars continue to refer to decades after their initial publication. Kent’s (1964) view of comprehensive planning is distinct from the rational comprehensive model of planning,
which functions by clearly outlining all potential objectives and policy options, comparing them, and ultimately choosing the optimal planning strategy (Lindbloom and Braybrooke, 1963). It was Kent’s vision of the urban general plan that switched comprehensive planning practice away from considering every alternative before making a decision. Rather, Kent advocated for comprehensive plans to serve as toolboxes of policies to be utilized in response to future circumstances to achieve city goals and objectives (Innes, 1996).

Kent describes three necessary components for comprehensive plans: comprehensiveness, explicit reasoning, and generality (Kent, 1964). Kent states that comprehensive city plans must be comprehensive in that they cover the entire city. Plans must focus not only on infrastructure but also on the relationships between the many factors that affect the growth and development of cities including the physical and nonphysical, local and regional, and social and environmental. Kent also stresses the importance of considering technological, economic, and demographic forecasts while developing comprehensive plans. Comprehensiveness is the key, he writes, to promoting the public interest (which constitutes the community at large rather than individuals or powerful stakeholder groups) (Kent, 1964).

Explicit reasoning requires that plans clearly identify the facts from which their visions were developed and justified. This allows for decision-makers to make informed final judgments about if and how to implement the policies outlined in the city plan. Kent also stated that the principle of generality is critical to comprehensive planning. Plans should not serve as a blueprint for the city; rather, they should be general and focused on larger issues facing the city and big ideas for their resolution. Because cities and
communities are complex and constantly evolving, plans should not be used as ideal models for development. Rather, they should be used as tools for democratic discourse (Kent, 1964; Innes, 1996).

Long-range comprehensive planning is an exercise in anticipatory problem solving and is a process through which community needs and goal setting objectives can be identified in an organized way. In theory, comprehensive planning is intended to stand up for common interests rather than those of a limited, powerful few. Ideally, comprehensive planning is an on-going, dynamic process in which plans are revisited and reevaluated regularly after their adoption. Because of the complex, adaptive nature of cities and communities it is important for plans to be updated so that they remain relevant to changing needs, priorities, and challenges.

Early U.S. city and regional planning developed in response to complex urban problems including social inequity and environmental degradation. Over time, problems changed and community priorities were redirected towards new, emerging urban issues. For example, between the 18th and 19th centuries, the Industrial Revolution drastically changed the function and form of cities. In his book, *Urban and Regional Planning*, Peter Hall describes the noisy, disease-riddled cities of the Industrial Revolution as the most important planning problem of the period. Urban economic growth was threatened by inadequate infrastructure and unsanitary conditions and planners were motivated to find fast and innovative solutions to the industrial city (Hall, 2002). Today, issues of disaster resistance, social equity, and economic development have surpassed issues of sanitation and undesirable industrial development as leading urban planning concerns.
The literature identifies two fundamental purposes around which planning problems pivot: *place making* and *conflict resolution* (Healey, 1998). A clear understanding of the priorities associated with conflict management and place making is useful for setting the stage for conceptualizing contemporary planning theory and practice. Place making involves the promotion of quality places. The aim of place making is to use design as a way of achieving broad economic, environmental, and social objectives. The second fundamental purpose of planning is to facilitate the regulation of private land use rights and to manage conflicts having to do with land use and development. All regulation and conflict management are part of a larger effort to serve the public interest (Healey, 1998). Healey (1998) acknowledges that conflict management and place making are deeply interconnected. However, continued analysis of planning practice and structure has illustrated that the two priorities also diverge. Figure 3 illustrates how conflict management and place making can diverge and come together through a process of effective spatial planning.
Figure 3: Place Making and Conflict Resolution through Planning

Generally, place making happens through professional and stakeholder debates about ideas for achieving desired community outcomes. Place making focuses on the transformation of both policy and practice. In contrast, the process of conflict management is largely defined by the actions of legal and administrative entities. These entities are primarily concerned with disputes about the legality of property rights restrictions and focus on maintaining established structures of governance and regulatory systems (Healey, 1998).

Since the 1960s planning practice and scholarship have transitioned from a focus on physical design to a focus on process. Before the 1960s, planners brought their creative ideas to the public by guiding the development of cities, towns, and regions. Urban planning in the United States was characterized as a largely technocratic process, dominated by independent experts who used objective scientific analysis to manage
resources and make infrastructure decisions. The preferred model in the profession was decision-making free of political interference (Berke, 2002; Wondolleck and Yaffee 2000; Susskind et al., 1999; Beierle and Cayford, 2002; Gunton and Day, 2003).

During the 1960s and 70s, rational planning, a model of planning based on systems theory and the scientific method, emerged in response to numerous social and environmental crises (Berke, 2002). However, communities and decision-makers began to question the efficacy of traditional planning as widespread urban problems including racism, pollution, poverty, and financial failure continued to plague metropolitan areas and regions (Berke, 2002). As a result, planners began to take a more comprehensive, systematic, and analytical approach to their work.

After the 1960s, urban planning was largely dominated by incremental projects, rather than large-scale ones (Berke, 2002). This transition was due, in part, to growing dissatisfaction with the top-down, expert dominated approach to city building that was often exclusionary and counterproductive to achieving larger community goals (Altshuler, 1965; Davidoff, 1965). The Civil Rights Movement helped catalyze the development of the participatory planning model and during this time urban areas were important places of political expression and civic dissent. Scholars and communities were acutely aware that early urban renewal and highway development projects disproportionately affected low-income, minority neighborhoods. This contributed to a significant decline in the public’s trust of rational planning. In response to public dissatisfaction over planning policies involving resource extraction, urban renewal and transportation, planners formally acknowledged democratic decision-making as the
Ultimate values, competing priorities, and resource constraints sparked the creation of two new planning paradigms in the U.S. Both mediation and advocacy planning emerged as new ways for planners to think about their role in decision-making and city building. Mediation, also known as alternative dispute resolution (ADR), calls for planners to act as intermediaries between conflicting stakeholders. In this model, the goal of the planning process is to guide decision-making in a way that produces mutually beneficial solutions (Bacow and Wheeler, 1984; Susskind and Cruikshank, 1987). Proponents of the mediation method argue that they are cost efficient, and more likely to resolve conflict than other approaches (Gunton and Day, 2003). Moreover, because planners seek win/win solutions to conflicts, the participatory method is believed to produce more lasting, equitable solutions.

Advocacy planning developed as a new decision-making strategy intended to serve disadvantaged and marginalized stakeholders. Like mediation, advocacy planning acknowledges that different stakeholders often have competing interests. Planners operating under the advocacy model promote the interests of the most underrepresented stakeholders and cultivate community participation in an effort to simultaneously create plans and empower the public (Davidoff, 1965). In the 1950s the dominant view of the public good was what is good for business is good for all (Hester, 1996). However, planners began to challenge this belief by facilitating the development of comprehensive plans for diverse interest groups and they began advocating for development strategies that represented multiple perceptions of the city. Some scholars argue, however, that
although there are clear benefits to this approach to planning, it leaves little room for the cultivation of holistic, larger-scale visions of the city (Clavel, 1994; Neuman, 1998; Berke, 2002).

Hazard Mitigation in the United States

Currently, much of the responsibility for reducing hazard losses in the U.S. is shared by the federal government and numerous local governments and special jurisdictions. Historically, U.S. disaster management was founded on civil defense and behavioral science research (Drabek, 1991; Pearce, 2003). Emergency managers and planners traditionally followed a bureaucratic model of hazard mitigation planning and drew from privileged technical information to inform their risk identification and goal setting activity. As a result, the focus of planning activity was often skewed towards assessing and mitigating geophysical vulnerabilities rather than addressing social dimensions of hazard risk (Colten, 1992; Colten & Sumpter, 2009; Vale & Campanella, 2005; Drabek, 1991; Pearce, 2003).

Before the 1950s a comprehensive disaster management program did not exist in the United States and disaster response and recovery was funded by congress on an incident-by-incident basis. It was not until the Federal Disaster Assistance Program was enacted in 1950 that the federal government began addressing disasters in a coordinated manner. In 1979 President Jimmy Carter signed Executive Order 12148, establishing the Federal Emergency Management Agency (FEMA), and effectively consolidated the nation’s historically diffuse emergency related programs into one organization.
<table>
<thead>
<tr>
<th>Year</th>
<th><strong>Federal Program or Act</strong></th>
<th><strong>Details</strong></th>
</tr>
</thead>
</table>
| 1950 | Federal Disaster Assistance Program | • Grants President broad power to respond to crisis  
|     |                                           | • Authorizes Federal government to respond to major disasters |
| 1970 | Disaster Relief Act of 1970 | • Authorizes the use of Federal loans and tax assistance to individuals affected by disasters  
|     |                                           | • Authorizes Federal funding for repair and replacement of public facilities  
|     |                                           | • Introduces hazard mitigation as a Federal priority |
| 1973 | The Flood Disaster Protection Act | • Makes flood insurance mandatory for the protection of property located in Special Flood Hazard Areas |
| 1974 | Disaster Relief Act of 1974 | • Establishes process for Presidential disaster declarations |
| 1979 | Executive Order 12127 | • Merges separate disaster-related responsibilities into FEMA |
| 1988 | Robert T. Stafford Disaster Relief and Emergency Assistance Act | • Legislates cost sharing requirements for public assistance programs  
|     |                                           | • Requires State mitigation plan as a condition of disaster assistance  
|     |                                           | • Encourages pre-disaster mitigation planning at the state level through grant programs  
|     |                                           | • Provides funds for states and local governments to manage public assistance projects |
| 1997 | Project Impact: Building Disaster Resilient Communities | • Emphasizes local community efforts to mitigate hazards and reduce vulnerability  
|     |                                           | • Goal: to achieve “community buy-in” for mitigation projects |
| 2000 | Disaster Mitigation Act of 2000 | • Provides incentives for close coordination of mitigation planning and implementation efforts between State, local and Tribal entities  
|     |                                           | • Establishes mitigation planning requirements for local and Tribal governments as a condition of mitigation grant assistance |
In the 1980s, in response to increasing losses from disasters, the U.S. government reevaluated the nation’s emergency management system. Ultimately, the U.S. government took on the responsibility of managing increasing hazard risks. This was exemplified by the passing of the Robert T. Stafford Disaster Relief and Emergency Assistance Act in 1988. The Stafford Act represented a sea change in national emergency management priorities by establishing mitigation as the most important means for combating increasing disaster losses. Congress acknowledged that special measures were necessary to assist state and local governments in providing aid, assistance, emergency services, and reconstruction aid to areas that have been impacted by hazard events. A key component of their strategy involved the encouragement of pre-disaster hazard mitigation planning at the state level as a mechanism for reducing overall losses from disasters.

Over time, the emergency management community has increasingly acknowledged the diversity of interests and stakeholders within a community as a critical piece of the mitigation approach. In 1997, FEMA moved forward with an innovative, community-based mitigation initiative called Project Impact: Building Disaster Resilient Communities. Project Impact was an attempt to reduce the impacts of natural disasters by helping communities carry out risk assessments and needs prioritization before a disaster event. By encouraging communities to build collaborative public/private partnerships during mitigation planning Project Impact set the stage for the development of appropriate, politically palatable, long-term strategies to protect communities from disaster impacts and loss.

In 2000, the Disaster Mitigation Act (DMA 2000) amended the Stafford Act and enacted a new set of rules requiring that state, local, and tribal entities coordinate their
mitigation planning and implementation efforts. Under DMA 2000, state mitigation plans are still required as a condition of federal disaster assistance. However, the act introduced incentives for the development of local scale mitigation plans. DMA 2000 now requires that State and local communities have approved hazard mitigation plans in place in order to be eligible for pre- and post-disaster hazard mitigation grant funds. The FEMA crosswalk for local hazard mitigation plan approval also includes a public participation component. FEMA consistently stresses that the mitigation planning process is just as important as the mitigation plans themselves. Although local and state hazard mitigation planning processes can happen in a diversity of ways, by offering incentives for multi-stakeholder coordination during the planning process, DMA 2000 strongly encourages participatory planning activity. Unfortunately, DMA 2000 planning requirements lack adequate guidelines for achieving meaningful, collaborative public participation activity during local hazard mitigation planning. Currently, there is a great need for an additional review crosswalk to be established that includes guidance on how to acquire knowledge and expertise specifically from vulnerable and marginalized community groups.

Vulnerability Reduction through Hazard Mitigation

In 2005, in response to intensifying hazard losses associated with unplanned urbanization, poverty, environmental degradation, and population growth, the Second World Conference on Disaster Reduction broached the subject of disaster resilience. In January 2005, the *Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters* was endorsed by 168 UN member states (UNISDR, 2005). The Hyogo Framework for Action (HFA) recognizes that global
disaster risks will only continue to magnify, due in part to the vulnerability implications of unplanned urbanization. The framework encourages countries to undertake major efforts to reduce their disaster risk by 2015 and outlines five priority areas for action. Priority area four calls for the incorporation of disaster risk reduction into urban planning activity as a method for reducing underlying risk factors (UNISDR, 2005).

The HFA represented an important step towards integrating disaster risk concerns into planning practice. The framework emphasizes social vulnerability reduction through largely participatory approaches to risk assessment. “Both communities and local authorities should be empowered to manage and reduce disaster risk by having access to the necessary information, resources and authority to implement actions for disaster risk reduction” reads the HFA (Section IIIA, point 13.f). This statement is significant because it explicitly linked disaster risk reduction to community empowerment strategies including public participation and control over information, resources and authority for the first time at the global scale.

In their publication *Words Into Action: A Guide for Implementing the Hyogo Framework* (UNISDR, 2007) the United Nations International Strategy for Disaster Reduction stresses the importance of community-based, collaborative decision-making processes in disaster risk reduction efforts and emphasizes the need to develop a holistic set of vulnerability indicators (both social and biophysical) as key resilience building strategies. It also illustrates the ineffectiveness of explaining the impacts of disasters on complex social, environmental, and economic systems through the use of strictly hazard or environmental indicators (UNISDR, 2007).
Today, the HFA serves not only as a tool for helping nations prioritize their risk reduction resources, but also as a framework for risk reduction efforts that embrace collaborative processes and incorporate information derived from communities through multi-methods approaches. The Hyogo Framework set the stage for the ongoing discourse on hazard mitigation planning practice in the context of social vulnerability reduction and citizen participation.

*Assessing Vulnerability*

As part of the hazard mitigation planning process, emergency managers and planners conduct comprehensive risk and vulnerability assessments. These assessments are used as tools for developing plans that help communities understand and manage disaster risks. There exist a number of models and approaches to vulnerability assessment and these assessments can be conducted at various scales including national, state, regional, and neighborhood levels.

Fundamentally, vulnerability assessment is a process of identifying and conveying interactions between the built environment, political structures, socio-economic conditions, and the physical hazard risks in a community. They play an important role in establishing a knowledge base of information about unique hazards and social contexts of a particular place, and they are meant to reveal the interactions between humans and the environment at a given location (Turner et al., 2003).

Vulnerability analysis emerged from an extensive body of research on risk, hazards and global environmental change. One of the salient lessons of this body of research is that vulnerability is a unique and inherent characteristic of a community that
changes continuously over time. Therefore, focusing on hazards alone is insufficient for understanding the impacts of hazards on a social-ecological system (Mileti, 1999; White & Haas, 1975; Cutter et al., 2003; Kasterson et al., 2003).

Currently, there is a spectrum of vulnerability assessment models that can be characterized by the varying degrees of attention given to social vulnerability factors and local community capacity (Phillips et al., 2009). These models also vary by the processes through which information and data about vulnerability are collected. Some vulnerability assessment models focus on single or multi-hazard risks (FEMA, 1997; Coburn, Spence, & Pomonis, 1994; Phillips et al., 2009), while others include limited assessments of social determinants of risk (Cutter, Boruff, & Shirley, 2003; Phillips et al., 2009). In addition, there exist models that strive to capture locally-derived community data from citizens in order to holistically assess local capacity (Phillips et al., 2009). Table 3 outlines the spectrum of current U.S. hazard vulnerability assessment models.\(^1\)

\(^1\) Table derived from Phillips et al. (2009)
<table>
<thead>
<tr>
<th>Approach</th>
<th>Outcomes</th>
<th>Data Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single hazard assessment</td>
<td>Documentation and/or risk model for a specific area</td>
<td>Single hazard risk information; Historical event and impact data; Monitoring data for model generation or model output</td>
</tr>
<tr>
<td>Multi-hazard assessment</td>
<td>Inventory of all hazards in a given location; Mapping and quantitative technical analysis of multiple hazard risks</td>
<td>Single hazard risk information; Historical event and impact data; Monitoring data for model generation or model output</td>
</tr>
<tr>
<td>Basic CVA (community vulnerability assessment)</td>
<td>Includes risks of multi-hazards; Explicit attention is given to understanding socioeconomic conditions with respect to hazard risks</td>
<td>Existing secondary data sources for social analysis and potential hazards; US Census data for socioeconomic analysis; May include few locally derived datasets</td>
</tr>
<tr>
<td>Intermediate CVA</td>
<td>Holistic treatment of vulnerability (includes additional data beyond US Census for social and economic analysis); Includes information on coping capacity</td>
<td>Supplements U.S. Census data with local-level sources of data; Includes indicators of capacity, including community resources; Inclusion of limited primary data from local surveys or focus groups</td>
</tr>
<tr>
<td>Community-based vulnerability assessment</td>
<td>Social vulnerability analysis expanded to include top-down and bottom-up information; Process involves capturing community knowledge and perceptions and incorporating them into the assessments</td>
<td>Collection of primary data via collaborative techniques; Best practices involve the engagement of stakeholders of all types and community-driven data collection efforts; Collection of information about community support networks</td>
</tr>
</tbody>
</table>

At the top of the table, the more traditional vulnerability assessment models include outcomes that consist solely of inventories of technical hazard risk data (Single and Multi-hazard vulnerability assessments). The intermediate models represent increasingly community-based approaches, which include varying degrees of contextual
information – such as population demographics, economic factors, and environmental conditions – in their data requirements and outcomes (Basic CVAs) (Phillips et al., 2009).

Examples of more comprehensive mitigation models supplement technical vulnerability analyses with locally derived information and community knowledge in an attempt to create context-specific planning goals and policy decisions (Intermediate and Community-based CVAs). Community-based approaches to vulnerability assessment are considered the best way to develop mitigation plans that successfully incorporate valuable community knowledge, including local sources of capacity and social determinants of vulnerability (Comfort et al., 1999; White et al., 2001; Godschalk, 2003; Wisner et al., 2004, Phillips et al., 2009).

Despite the range of assessment models, contemporary hazard mitigation planning policy has exhibited a shift towards an increasingly collaborative, resilience-based approach to risk reduction. For example, FEMA grant programs now mandate public participation in disaster management and hazard mitigation planning. This shift is due, in part, to increasing evidence of the benefits associated with multi-stakeholder knowledge sharing and discourse – particularly in the context of hazard mitigation planning.

**Engaging the Public through Participatory Planning**

Traditionally, expertise and knowledge have been understood as the products of scientific or professional occupations. However, scientific and institutional experts do not always know best. Context determines who “the expert” is and strongly contextualized local knowledge can expand the professional radius of expertise (Yli-Pelkonen & Kohl, 2005).
Typically, local knowledge is not the product of systematic scientific study. Rather, its validity stems from a lengthy series of local observations and experiences over time. A post-Katrina study conducted by geographers Colten and Sumpter (2009) explores the relationships between local knowledge, scientific expertise and disaster resistance in the context of pre-Katrina New Orleans. Motivated by a key concept of resilience thinking – that societies can learn from hazard events and use their accumulated social memory to adapt to future catastrophes – their study looks at local planning activity in New Orleans after Hurricane Betsy in 1965 and at how information about the community’s experience with Betsy was used for hazard management planning leading up to Hurricane Katrina in 2005.

Colten and Sumpter (2009) found that two critically important lessons from Hurricane Betsy were omitted from post-Betsy hazard management activities. One of those missing lessons was that the areas of greatest flood vulnerability were located in eastern New Orleans, the lakefront, and downstream parishes. The failure to apply this information to future comprehensive land use planning prevented the city from taking action to guide development towards the safest locations. This, unfortunately, resulted in a decrease in the overall resiliency of the city. Within a matter of years after Hurricane Betsy, hurricane protection levees were constructed around the most historically vulnerable areas and the city. Additionally, some of the most rapid growth within the city took place in eastern New Orleans. “The flood footprint had no bearing on development,” write Colten and Sumpter, “and in effect the new […] levees eclipsed memory” (Colten & Sumpter, 2009, 360). Over time, planning documents and development planners
continued to build and continued to ignore past flooding in eastern and lakefront New Orleans further eroding the resilience of the city.

The previous study illustrates an example of the potential negative impacts associated with hazard mitigation planning approaches that fail to learn from local communities and incorporate local historical knowledge. Ultimately, the failure of New Orleans to integrate local knowledge and memory into hazard mitigation and land use planning eroded the resilience of the city and set the stage for the costliest, and perhaps the most resentful disaster experience in U.S. history.

The hazards and disaster literature suggests that the adoption of local scale hazard mitigation plans helps to reduce hazard losses (Nelson & French, 2002). Moreover, hazards researchers have found that mitigation plans are unlikely to be effective unless they involve the participation of a diverse range of stakeholders during plan creation (Burby, 2003). Empirical research has also shown that both the quality of hazard mitigation plans, and the likelihood that they will be implemented after adoption, tends to increase with the level of public participation during plan making (Burby, 2003; Godschalk et al., 2003). The following sections discuss the foundations of participatory planning, explain a framework for understanding the impacts of various types of participatory and review the existing body of literature related to identified benefits and drivers of public participation in planning.

The Theory and Practice of Communicative Planning

Theories of communicative planning, and models of discursive, participatory and collaborative planning all emphasize an inclusive, democratic approach to making plans.
Over the last several decades, planning practice has adopted increasingly interactive and communicative decision making and knowledge building strategies. Although some of the terminology and descriptions of the communicative planning model have changed over time, the fundamental ideal of planning as a collaborative process has endured (Forester, 1982; Healey, 1998; Innes, 1996; Taylor, 1998; Innes and Booher, 1999a).

Jürgen Habermas developed the theory of communicative rationality in the 1980s as a way of describing a set of ideal conditions for discourse and knowledge building. The theory challenged instrumental rationality by basing knowledge building and reasoning on inter-subjective exchange. Habermas writes that communicative rationality draws from the practical consciousness and life experiences of stakeholders. Because physical, social, and experiential contexts overlap, it is argued that communicative planning processes generate more robust forms of knowledge through deliberation and interaction (Habermas 1981, 1989; Outhwaite, 1994). New forms of knowledge and perception are created, collective values and norms evolve, and the communicative planning process is able to create a new common language (Healey, 1998).

According the Habermas, if ideal conditions for communication and knowledge building are met during inter-subjective exchange, then discourse will result in *emancipatory knowledge*. Habermas theorizes that emancipatory knowledge allows people to transcend conceptual limitations created by society’s socio-cultural and political power structures (Habermas, 1981, 1989; Innes and Booher, 1999b). For this reason, he argues that emancipatory knowledge is vitally important in a rapidly changing world. As change occurs more quickly it becomes increasingly challenging to maintain an accurate, complete understanding of our urban, social, and environmental systems.
Therefore, emancipatory knowledge is a pathway towards innovative solutions and new ways of understanding our increasingly complex world.

Habermas’ theories built a case for renewing planning practice based on a critique of the highly deductive, rational foundations of the discipline. The idea of communicative processes was introduced to the planning discipline by Forester (1982) and represented a shift in perceptions about presumed objectivity and the use of information and knowledge in decision making. Innes and Booher (2010) call this shift in planning and policy making ‘collaborative rationality.’ Grounded in Habermas’ theory of communicative rationality, collaborative rationality has to do with dialogue and deliberation. Within the communicative stream of planning thought, perfect truth, information, objectivity, and collective knowledge are ideals that cannot be fully achieved. However, through collaborative deliberation planners can most effectively aim towards these ideals and produce better, more sustainable outcomes than those achieved through individual, expert based analysis.

Collaborative rationality may also help remedy uneven power relations that exist in traditional governance regimes and planning systems. Communicative planning theory asserts that planning is deeply political and largely dictated by power structures. The agendas of those in power are often favored and stakeholders are rarely afforded equal participation or opportunities for decision-making (Healey, 1997; McGuirk, 2001). Habermas (1981) argues that instrumental rationality creates a reality of communicative distortion, in which false consensus is reached through discourse in the context of unequal distributions of power. In theory, collaborative rationality can transform power relations by creating deliberative arenas for stakeholders to participate and share. These
power-neutral forums enable temporary conditions of shared power and create forms of knowledge and rationality in which distortion is minimized (McGuirk, 2001; Innes and Booher, 2010).

*Participatory Planning: Practice and Theory*

Citizen participation in U.S. planning has an extensive and lengthy history. The emergence of increasingly democratic planning paradigms was initially a response to the failure of traditional planning models to manage complex social, economic, and environmental problems. For example, transactive planning (Friedmann, 1973), consensus building (Innes, 1996; Innes & Booher, 1999), and communicative planning (Margerum, 2002; Healey, 1992; Innes, 1996) all emphasize inclusive, democratic approaches to making plans. To varying degrees, each paradigm situates communities at the core of planning practice.

In the 1920s the U.S. Department of Commerce developed state planning legislation that required local governments to offer citizens the opportunity to review and comment on plans being developed by practitioners. The state of Hawaii’s innovative growth management law of 1962 was the first state level legislation of its kind, and required citizen involvement in planning (Lowry et al., 1997).

One of the most prominent examples of early federal-level citizen participation requirements was the Economic Opportunity Act of 1964. The Act mandated community antipoverty efforts be overseen by local action programs that were developed and directed with the “maximum feasible participation of the residents of the areas and members of the groups to be served” (Economic Opportunity Act of 1964, PL 88-452,
title II). The Act facilitated the establishment of over a thousand community action programs. However, critics argued that the Office of Economic Opportunity, the entity that oversaw the program, misinterpreted Congress’ intent. It was argued that the Economic Opportunity Act spurred very little genuine participation of underrepresented stakeholders and that The Act promoted clashes between individual local action programs and elected city officials (Moynihan, 1969).

The 1954 Urban Renewal Program was the first federal-level citizen participation mandate in the United States. It was expanded during the 1960s Model Cities and War on Poverty programs. Throughout the 1970s Congress added participation requirements to a diversity of federal regulations. For example, citizen participation became a requirement of the Coastal Zone Management Act and the Energy Reorganization Act.

What was the government trying to achieve by mandating public participation? The planning literature reasons that the early motivation behind these mandates was to increase the accountability and commitment of local governments to the principles of democracy. These principles include the right to information, the right to be consulted with, and the opportunity to express goals, priorities, and opinions on government decisions. At the core of democracy is the necessity of representing the interests of marginalized, powerless, and disadvantaged stakeholders in governmental decision-making and, in theory, public participation in planning contributes to the realization of these broader democratic principles (Arnstein, 1969; Burke, 1979; Day, 1997; Godschalk and Mills, 1966; Fainstein and Fainstein, 1985).

The shift towards increasingly bottom-up approaches to planning led to the acceptance of a broad range of collaborative planning strategies. Diverse approaches to
community engagement – including public meetings, advisory committees, charrettes, workshops, and task forces – became increasingly common during the 1960s. Since then, researchers have evaluated the success of these approaches for generating increased public participation, empowerment, and plan implementation outcomes (Beierle & Cayford, 2002; Gunton & Day, 2003; Arnstein, 1969).

In her article *A Ladder of Citizen Participation* Sherry Arnstein (1969) presents a theoretical ladder to illustrate how even with the emergence of new state and federal laws requiring public participation in government decision-making, the majority of that participation ranks low on the ladder of meaningful participation. The community participation outcomes can be explained in part by the specific collaborative planning activities that guide the engagement of, and interactions between, diverse participants during the planning process. Arnstein’s ladder has eight rungs that are divided into three tiers illustrating a hierarchy of public power and citizen participation (Figure 4).
Figure 4: Arnstein's Ladder of Citizen Participation

The lowest rungs of the ladder are manipulation and therapy. At this level of the ladder planning processes are non-participatory. In ascending order the middle rungs of the ladder are informing, consultation, and placation. These rungs are described as degrees of tokenism, characterized by one-way flows of information, shallow surveys, and limited decision-making power by citizens.

The top three rungs of Arnstein’s ladder represent partnership, delegated power, and citizen control. At this level, the rungs represent ascending degrees of citizen power. In the partnership model, power is legitimately redistributed through processes of negotiation and discourse between citizens and those in power. Delegated power affords
citizens the power to make decisions and to provide accountability to the public. Finally, citizen control describes a level of participation in which the powerless are granted the authority to collect information, prioritize programs, and direct planning in its entirety.

As illustrated by Arnstein’s ladder, different citizen engagement activities lead to varying degrees of participation and power sharing, ranging from manipulation, to placation, to citizen control. The knowledge systems of communities are complex and are continuously being transformed through experience, social factors, and even by the influence of power relations both internal and external to a community. Ultimately, Arnstein’s ladder emphasizes how power and control over decision-making are critical for achieving meaningful and informed public participation.

To date, the nuances between public participation strategies have been evaluated and distinguished using similar value-based scales including equitability, inclusivity, impartiality, and transparency. Density and frequency of community participation in planning have been shown to depend strongly on the identification of appropriate community participants as well as on the choices planners make regarding specific collaborative planning techniques (Brody, 2003; Brody, Godschalk & Burby, 2003). (Godschalk et al., 2003; Innes & Gruber, 2005).

Decision-making in American policy and planning has long relied on scientific expertise for guidance. As a consequence, the implementation of citizen participation has often been a difficult concept for many policy makers to grasp and has frequently been excluded. In many cases the scope of relevant stakeholders seems infinitely large. There may exist such a wide variety of methods for involving citizens in planning that selecting the most appropriate approach can seem like an insurmountable challenge. For this
reason, Arnstein’s ladder is a useful framework for identifying appropriate approaches to public participation that are based on larger community and project goals.

Local Knowledge

Santa Fe Institute founder George Cowan writes that that the science of the 21st century will be the science of complexity (Waldrop, 1992). Traditionally, reductionism has been the way in which scientists have attempted to understand problems. The idea behind reductionism is that if we understand the parts, then we can understand how the system works as a whole. In the context of planning, however, it has become increasingly clear that the rational model of understanding systems no longer reaches desired outcomes. Why? Some systems cannot be evaluated using the rational, reductionist model because the way in which the components of the system interact is key to understanding how the whole system works. Systems like these are called complex systems. Complexity theory emerged as a framework for understanding how complex systems function and change. A number of disciplinary perspectives apply complexity theory from ecologists and social scientists, to economists and computer scientists.

Over time, new understandings of complex systems emerged including the concept of complex adaptive systems. Planning systems and the social-ecological communities functioning within them have been described as complex adaptive systems, defined by changing environments, numerous stakeholders and values, and interacting parts. Hopkins (2001) writes that planning is only useful to complex adaptive systems if the process is integrated as a functional element within the system rather than as an external means for achieving control. This is because complex adaptive systems achieve
higher levels of performance when innovation and dramatic shifts in activity are able to occur. Innovation and adaptation depend, however, on adequate transfers of information and diverse forms of knowledge between interacting stakeholders.

Innes and Booher (1999) stress that in order to understand the capacity of a complex adaptive system to learn, build shared meaning, and be resilient to unexpected shocks, it is critical to evaluate issues of power, networks, and self-organizing that are inherent to the system (Innes and Booher, 1999). Network theory has merged with planning research on the subject of hazards management and mitigation planning. For example, increasing drought risks and uncertainty about exposure due to climate change have propelled fire management to the forefront of U.S. emergency management agendas. Goldstein’s (2008) work on adaptive learning, collective memory, and fire risk highlights the potential for networks to impact residential knowledge and local resilience. Goldstein’s study found that in the case of the San Diego Fire Recovery Network (SDFRN), it was the local network’s diversification of responses to environmental change and uncertainty that contributed to increased community resilience. The informal network provided the community with a range of alternative social–ecological relationships and configurations. As a result, it could offer flexible options for reconfiguration without causing catastrophic change to the system. To put it another way, the network enhanced the system’s ability to apply flexible interventions and persist at the ‘edge of chaos’ (Goldstein, 2008).

Researchers have also explored the implications of inflexible management regimes on complex adaptive systems. In the context of post-disaster recovery planning, research shows that state bureaucracies rarely increase post-disaster social-ecological
resilience (Adger et al., 2005; Folke et al. 2005). This is attributed to the governmental tendency to focus on a “return to the status-quo” after a disaster event. In contrast, informal, community networks are more likely to develop a diversity of innovative responses to rapid change and alternative states of being, thus enhancing community resilience (Folke et al., 2005; Goldstein, 2008). Goldstein argues that informal networks, or “skunkworks,” are free from obligation, scrutiny, or pressure (2008). Therefore, they are able to innovate and devise more creative, flexible solutions that transcend organizational barriers and are adaptable to a diversity of unexpected scenarios.

In addition to evaluating how new forms of knowledge and flexible stakeholder networks are developed during participatory planning, hazards and communicative planning researchers have explored the potential of participatory processes to mobilize social memory and increase local resilience (Folke et al., 2005; Goldstein, 2009). Social memory is a part of every human society’s cultural capital and effectively links past experiences with present (and future) plans and policies (Folke et al., 2005). Although it draws on experience, it also allows for innovation, creative adaptation, and experimentation within a larger framework of accumulated community experience.

In their 2009 mitigation strategy study, Berke, Song, and Stevens found that citizen participation rates during site plan review increased when planners employed highly communicative participation techniques (specifically, community forums, goal-setting workshops, subcommittees, and citizen advisory committees). In comparing the characteristics of the relatively effective participation techniques with those that were ineffective, Berke, Song, and Stevens (2009) concluded that the participation of
stakeholder groups was higher when planners chose to use discursive, interactive and personal information transmission strategies.

Moving forward, the term “participatory planning process” is used to encompass all collaborative planning and decision-making processes that seek to reach agreement by a broad spectrum of stakeholders on a planning process output. For example, problem definition, goal setting, fact finding, priority setting, policy making or implementation strategy.

Participatory planning is, at its core, the act of creating new knowledge. Participants contribute their perspectives to the planning processes and diffuse knowledge to others in the process (Goldstein, 2009; Innes and Booher, 2010). The inclusion of knowledge provided by non-expert stakeholders can be beneficial to planning processes because the perspectives of individuals outside of the professional urban planning sphere often contribute new solutions that are based on collective memory and are closely aligned with local contexts. Moreover, local knowledge has the potential to contribute insights about environment and place that the planning discipline may never have known or might have forgotten (Burby, 2003; Laurian, 2003; Colten & Sumpter, 2009; Coburn, 2003).

Expertise plays only a small part in the local resilience building process, and formal, scientific knowledge is complimented by lay, or local, knowledge. As adapted from Coburn (2003, 421), local knowledge is:

- Knowledge of specific relationships, events, characteristics and circumstances, as well as important understandings of their meaning, in local contexts or settings;
- Generally acquired via life experience and mediated through cultural tradition;
• Evidence of one’s eyes that is tested through years/generations of experiences, rather than a hunch or spontaneous intuition; and

• Is made legitimate through community stories, public narratives, street theater and other public forums, as opposed to professional knowledge which is tested through peer review, through the media, or in the courts.

In a complex world facing uncertain, diverse, and catastrophic climate change hazards, Innes and Booher (2008) make the case that adaptability and resilience require enlisting a full range of “knowledges,” including those of non-experts and the seldom heard (Innes and Booher, 2008). In reality, however, local knowledge is often marginalized, particularly when it is communicated by the poor, politically underrepresented, or socially disconnected.

Better Plans, Safer Communities?

In the U.S., scholars and practitioners frequently call for broad public participation in planning as a condition for positive planning outcomes. It is frequently argued that although it often takes more time and money to involve diverse groups of stakeholders in the process, the long-term savings associated with communicative hazard mitigation planning can make up for the initial investment and, overall, successful collaboration often results in the identification and implementation of more appropriate mitigation options (Mileti 1999). Only a few studies have empirically tested the assumption that community representation and participation during the planning process will lead to greater levels of project implementation and/or better plans. The following
section examines the body of work on the relationships between community participation in planning and the quality and implementation of local hazard mitigation plans.

*The Influence of Participation on Implementation and Plan Quality*

In the U.S., increasing disaster loss and vulnerability trends over the last three decades indicate that mitigation planning activity and public policy decisions at all levels of government have been ineffective at protecting lives and infrastructure from hazards and their impacts (Burby, 2006; Berke, Song, and Stevens, 2009). Mitigation planning research shows that successful vulnerability reduction requires the integration of various planning tools, better coordination with stakeholder agencies, and a more holistic approach to public participation. This belief extends beyond academia and into the policy realm. In its mitigation guide, FEMA emphasizes that mitigation planning approaches must go beyond the scope of traditional emergency management and incorporate areas of planning, development, economics, education, critical care, and cultural facilities. FEMA also underscores the importance of including the entire community in local planning activity (FEMA, 2001). The following sections highlight the empirical benefits of including the public in hazard mitigation planning activity.

*Internal Implementation Factors: The Plan and Its Quality*

From the perspective of FEMA, the goal of including non-expert stakeholders in local hazard mitigation planning is to reduce risk and vulnerability of people and property to future hazard events. In order for risk reduction goals to be realized, knowledge sharing and public education must occur as well as implementation of proposed mitigation actions.
Plan implementation outcomes are driven by a number of factors. These factors include planning agency (Dalton & Burby, 1994), the knowledge and commitment of developers to plan policies (Laurian et al., 2004; McNamara & Healey, 1984), project scale, interactions between agencies and developers (Burby et al., 1998), public involvement and quality of the plan itself (Dalton & Burby, 1994; Berke, Song, and Stevens, 2009). Although the literature on policy implementation is well developed in the political science and public administration disciplines, the planning literature contains relatively few studies related to plan quality the implementation of local plans.

Dalton & Burby (1994) conducted one of the key empirical studies on implementation outcomes from the planning perspective. Their research investigated the influence of states on development management. Dalton & Burby (1994) analyzed 176 communities across five states. In addition to confirming the importance of state mandates on plan quality, the study identified plan quality as a critical factor contributing to strong plan implementation outcomes (1994).

In an attempt to understand the relationship between hazard mitigation planning and loss prevention, a specialized segment of planning research developed around the notion of hazard mitigation planning documents as predictors of plan implementation outcomes (Talen, 1996; Hoch, 1998; Brody, 2003). Within this body of research, the concept of plan quality has been used as both an outcome variable for assessing planning processes and as a predictor variable for assessing the implementation of planned actions.

plans, by looking at the breadth of stakeholder groups involved in planning and at the presence of specific stakeholders. Statistical results found that the breadth of stakeholder groups involved in planning, as well as the presence of specific stakeholders (industry, government and NGOs), does significantly increase the quality of ecosystem management plans (Brody, 2003).

In 2004, Laurian et al. (2004) conducted a systematic, quantitative analysis of key determinants of plan implementation. Their analysis was based on 353 permits implementing six local environmental plans in New Zealand, and on surveys of the developers who obtained the permits and of the planning agencies that granted the permits. The research team found that plan implementation in this context was largely driven by the quality of the plans rather than by the characteristics of the planners (Laurian et al., 2004).

In 2009, Berke, Song, and Stevens (2009) conducted a study related to plan implementation outcomes in the context of hazard mitigation and risk reduction. The research team looked at the incorporation of hazard mitigation strategies into New Urbanist development projects and found that mitigation implementation was positively correlated with high levels of community participation during the planning process. Specifically, public participation during site plan review had a positive effect on the incorporation of hazard mitigation strategies into future development projects. Across the sample, the number of hazard mitigation strategies used in the proposed development projects increased with the number of stakeholder groups involved in the site plan review.

Berke, Song, and Stevens (2009) work supports the hypothesis that greater public participation increases the likelihood that hazard mitigation actions are implemented
during future development decisions. This conclusion is supported by previous research showing that local governments are more inclined to pursue hazard mitigation efforts when citizens call attention to hazards, and that the likelihood that citizens will call attention to hazards increases with the number of stakeholder groups engaged in the planning process (Burby, 2003; Godschalk et al., 2003).

Further exploration is needed to understand why stakeholder participation may lead to stronger planning outcomes and what kinds of participation activity lead to better planning. Considering increasing trends in risk and vulnerability, as well as the amount of time and money spent on the development of public participation strategies and on complying with federal and state participation mandates, the hazard mitigation community has much to gain from this line of inquiry.

Assessing Plan Quality

The current body of literature draws strong positive connections between plan quality and plan implementation (Laurian et al., 2004; Dalton & Burby, 1994), between public participation and plan implementation (Berke, Song, and Stevens, 2009; Brody, Godschalk, and Burby, 2003; Godschalk and Stiftel 1981; Kaiser, Godschalk and Chapin 1995), and between public participation and plan quality (Brody, 2003). The content analysis approach to evaluating plan quality has primarily been used to assess the quality of comprehensive development plans between communities with diverse regulatory and design approaches (Berke & French, 1994). Although emergency management concerns and priorities are different from those of urban development projects, many
understandings from the analysis of comprehensive plans are relevant to the evaluation of hazard mitigation plan quality.

Early attempts to evaluate plan quality focused on variations in decision-making processes used to create several development plans. Hill (1968) created a “goals-achievement matrix” as a method for ranking the plan alternatives based on their ability to achieve the goals laid out in the plan. Litchfield et al. (1975) later expanded upon this method of plan quality assessment by evaluating how different groups of community stakeholders were affected by different development plans.

Alterman and Hill (1978) later developed a consistency measure to determine how well comprehensive plans were being implemented across a range of detailed, site-specific plans. They determined consistency by comparing the proportions of land that were designated for the same use in comprehensive plans and in site-specific plans. State mandates that require local plans to be consistent with state goals began to rely on the consistency measure as a barometer of plan quality (Knapp & Nelson, 1992). The consistency concept is limited, however, because jurisdiction consistency with state mandates or comprehensive plans does not automatically guarantee high plan quality.

A number of important efforts to define the characteristics of high plan quality emerged from the literature soon after the consistency measure. As a body of work, these studies established consensus concerning the key planning characteristics that influence the decisions of local governments the most and, therefore, are most likely to lead to superior plan implementation outcomes.

Chapin and Kaiser’s (1979) work is cited as one of the most important studies related to the definition of core plan quality characteristics. The three core characteristics
of plan quality are as follows: a strong factual basis, clearly articulated goals, and appropriately directed policies/actions. Fact basis refers to the existing local conditions of a place, previous historical events and existing needs related to the physical and socio-economic development of a community. Goals represent general aspirations, problem abatement, and needs that are premised on local values. Finally, policies are general guides to decisions (or actions) about the location and types of development that are based on the planning goals (Chapin & Kaiser, 1979).

Empirical studies have applied the three core characteristics of plan quality to evaluate the ability of impact assessments to affect decision-making in local governments. In 1978, Fishman evaluated the land use and housing elements of comprehensive plans in 27 U.S. cities and concluded that the best plans contain specific, well-articulated goals that are linked to local conditions. Fishman’s study also underscores the need for policy language to be action-oriented. For example, using words like will or must, rather than might or should was characteristic of development proposals in the case cities that were more consistent with existing comprehensive plans (Fishman, 1978).

In 1990, Connerly looked at the quality of the housing elements of plans created ten Florida communities. His study provides several explanations for the high implementation of proposed planning actions in guiding the development decisions of local governments. First, he asserts that high quality plans have fact bases that are characterized by detailed inventories of local housing stocks and assessments of current and projected housing needs and capacities. Second, high quality plans have comprehensive goals that address a broad spectrum of housing needs. Third, high quality
plans contain clearly stated policies that are specific to the achievement of each goal. Each of the policies also articulate identified funding sources and implementation timelines (Connerly, 1990).

The body of research on the relationship between plan quality and local government plan implementation displays a clear pattern in support of the three plan quality components initially identified by Chapin & Kaiser (1979). The highest quality plans are typically those that a) have a strong factual basis that defines local needs, b) have clear and comprehensive goals that evidence a commitment to local needs, and b) have specific, action-oriented policies that are geared towards achieving plan goals. Although creating high quality mitigation plans is not the end goal, understanding how to create high quality plans is an important intermediary step towards achieving reduced vulnerability and loss from hazards and disasters.

**Linking Participatory Planning with Hazard Mitigation Plan Quality**

Even in states with highly progressive hazard mitigation policies and mandates, many local jurisdictions are currently developing low quality, cookie-cutter hazard mitigation plans. Hazard mitigation plan quality is substantially low across the country and, in a number of cases, quite variable even within states. Perhaps the most concerning trend is that many plans lack meaningful site-specific information about local capacity and social vulnerability, information that is essential to resilience-building (Schwab, 2011).

The burgeoning body of hazard mitigation planning research has refined the three core plan quality components developed by Chapin & Kaiser (1979) specifically for use
in the hazard mitigation planning context. Indicators for the fact base component of hazard mitigation plans cover the location and extent of hazard damage, including the magnitude of hazard events, the location of critical facilities, numbers of exposed populations, and evacuation clearance times. Indicators for the goals component of the hazard mitigation plan quality index cover physical hazard impacts (e.g. water quality impacts and the preservation of natural areas). The goals component includes goals related to physical and economic impacts of hazards (e.g. any goals to equitably distribute hazards management costs and reduce property loss), and impacts of hazards on public interests (e.g. any public safety goals or hazard awareness initiatives). The policy/actions component addresses actions associated with increasing community stakeholder awareness of risks and hazards, regulatory actions, mitigation incentives, actions taken to reduce structural losses, and actions related to post-disaster recovery.

Using the three core plan quality components, Wenger et al. (1980) assessed the quality of 71 local emergency plans. Through empirical testing, Wenger et al. (1980) concluded that the majority of pre-disaster emergency planning activities in their sample were oriented largely towards the production of plans as deliverables for the acquisition of funding rather than as tools for future development and policy-making. The highest quality plans in their study were those plans created by frequent community-wide sharing of information, fact-finding, and proposal generation (Wenger et al., 1980).

Hazards scholars Berke and French (1994) have also evaluated hazard mitigation plan quality, this time by studying the relationship between quality outcomes and state planning mandates in five states: California, Texas, Washington, North Carolina, and Florida. The five selected states provide a range of variation in geographic features as
well as in state mandate local planning characteristics. In their study, the characteristics of two mandate design features (structural features and facilitating features) were identified in the each of the local plans. Berke and French (1994) then showed gamma correlations between the structural and facilitating mandate design features, and local plan quality characteristics. Their research found that both types of mandate features are strongly related to the strength of policies within local plans, but they have weaker relations with goals and fact basis.

Berke and French (1994) suggest that the relatively weak relationship between planning mandate features and fact basis may be attributed to how fact base is formulated. Federal agencies largely determine the extent to which plans use information, more so than do state mandates. For example, federal agencies produce detailed flood insurance rate maps that most communities use for plan making. This finding may explain why their study found local commitment building to have the highest correlation with fact basis of all the mandate features. Berke and French suggest that as commitment to planning increases, communities are more likely to incorporate available mapping data into plan making (1994).

As previously noted, planning researchers currently measure the fact base component of hazard mitigation plans by identifying cited information including previous hazard damages, probability of hazard events and the location of critical facilities. However, despite the significant role that people play in the ability of a community to be resilient in the face of disaster, researchers have failed to assess the incorporation of social vulnerability concerns into their hazard mitigation plan quality assessments.
In response to this disconnect between theory and practice, this study has modified the fact base component of the plan quality assessment tool to include citations of social vulnerability information in mitigation plan scoring criteria. Specifically, fact base indicators have been refined to include contextual data on local demographics, education levels, health services, social services and economy, all of which are important indicators of local social vulnerability and key factors affecting the disaster resilience of a community (Brody, 2003; Godschalk, Kaiser, & Berke, 1998; Berke et al., 1998; Godschalk et al., 1999; Phillips et al., 2009). This methodological strategy is discussed in detail in Chapter 3.

Placement and Contribution of this Study

This dissertation research expands upon the current body of literature by assessing how various models of public participation, as well as local social vulnerability characteristics, affect hazard mitigation plan quality outcomes. This study does not attempt to identify the etiology or antecedent factors that explain public participation in hazard mitigation planning. Rather, it takes an exploratory approach to identify emerging themes related to variations in hazard mitigation plan quality between communities. The following section describes the conceptual framework that guides this research.

Conceptual Framework

As previously discussed, the literature includes a variety of variables that affect the impact of public participation on local hazard mitigation plan quality. A conceptual framework can help integrate these variables and organize analysis by identifying general sets of variables of interest. To this end, this study integrates three models developed by
Callon (1999), and adapted by Yli-Pelkonen & Kohl (2005), to describe the various degrees of involvement of lay-person stakeholders in the creation of the knowledge and information on which planning decisions are made.

Grounded in the social-ecological systems literature, Callon’s (1999) original models focus on the diversity of possible types of non-expert participation in planning. The first model, hereafter referred to as M1, is called the public education model. M1 describes the opposition between technical and experiential forms of knowledge. In this model, non-expert stakeholders have nothing to contribute to professional knowledge of risk, vulnerability or hazard mitigation during plan making. Here, local goal setting, planning, and decision-making are based solely on the knowledge and agendas of organizational stakeholders and that knowledge is derived primarily from historical data and modeling.

Model 2 (M2) is called the public debate model. Here, local non-expert stakeholders are perceived as having less robust levels of knowledge than professionals. They are, however, invited to participate (to a limited extent) in goal setting, risk assessment and mitigation prioritization. In this model, professional knowledge is enriched by local community information sharing and together, organizational and community stakeholders create a framework for decision-making.

Callon (1999) breaks up the M2 model into two sub-models in order to describe different types of participation in more detail. The two sub-models are: M2a, the public hearing model and M2b, the public representation model. The public hearing model (M2a) describes interactions in which hazard mitigation planners collect information directly from participants. In this model, the aim of the collaborative planning process is
for community knowledge to directly impact planning outcomes (Callon, 1999; Yli-Pelkonen & Kohl, 2005).

In the public representation model (M2b) community knowledge is heard indirectly through the use of community representatives. These representatives can be, for example, homeowner associations or local NGOs. In this model of participation, community knowledge can influence planning decisions; however, because planners are channeling it through community representatives, there is a greater risk of the information being misinterpreted.

Model 3 (M3), the co-production of knowledge model, represents circumstances in which non-expert stakeholders are actively involved in the information collection, goal setting, and decision-making that shapes local plans. In this model, community input is treated as equally important to planning and decision-making as is professional input. In some circumstances, community perspectives and experiential knowledge are even treated as more important. This can happen in situations where professional knowledge on a topic is scarce (i.e. when plans require information about social factors related to a community’s risk, vulnerability, or capacity). Here, local community knowledge becomes an essential part of information production and decision-making (Yli-Pelkonen & Kohl, 2005).

There exists a fourth model along the spectrum of participation. Model 4 (M4), or the community construction of knowledge model, illustrates a participation model in which hazard mitigation planners rely entirely on information, understandings, and priorities based on knowledge from local communities to inform their mitigation plan proposal. When hazard mitigation planners attempt to incorporate information about
social vulnerability and/or community capacity into local plans (i.e. social networks, information about community gatekeepers, or adaptive behavior based on experiential learning) professional knowledge about these social determinants of risk is largely non-existent. Therefore, “experts” must defer to local stakeholders, including socially marginalized or unseen groups, to construct an understanding of local social issues related to hazard risk and vulnerability (Wisner, 2006; Folke et al., 2003, 2005; Folke, 2006).

For the purpose of this study, the four models described above provide a functional framework by which to assess local hazard mitigation planning practice at the city scale. Moving forward, the models are used to categorize individual hazard mitigation planning schemes and to guide our evaluation of the relationships between stakeholder participation, social vulnerability factors, and plan quality outcomes.

The framework for this study, adapted by planning and social-ecological systems scholars Yli-Pelkonen & Kohl (2005), brings Callon’s four models together into a larger conceptual model of stakeholder participation during local hazard mitigation planning. The conceptual framework illustrates the interactions through which lay-person stakeholders participate in information production, goal setting and decision-making during hazard mitigation planning (Callon, 1999; Yli-Pelkonen & Kohl, 2005).

Below, Figure 5 illustrates the conceptual framework used in this study for categorizing stakeholder participation during local hazard mitigation planning. Models M1 through M4 are characterized by the specific participatory planning strategies used during the local planning process. The interactions between local community/citizen stakeholders, organizational stakeholders/technical experts and mitigation planning teams
flow according to the four vectors illustrated in Figure 5. The arrows A, B, C and D show the interactions between the participants and identify the key social process of collaborative planning. The dashed lines for interactions B, C and D illustrate that they are conditional interactions.

![Diagram](image)

**Figure 5:** Framework for Stakeholder Participation During Local Hazard Mitigation Planning

In this study, I evaluate interactions A through D in order to attribute a participatory planning model to each of the 34 local hazard mitigation plans included in the sample frame. Based on which interactions are present during a city’s mitigation planning.

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2 Adapted from Yli-Pelkonen & Kohl (2005)
planning process, one of the four participatory planning models – M1, M2a/M2b and M3, M4 – will be attributed to each of the 34 local hazard mitigation plans.

The framework of stakeholder participation during local hazard mitigation planning can be connected back to the existing literature related to participatory planning and mitigation planning outcomes. In 2009, Deyle & Slotterback (2009) found positive planning outcomes in counties where interactions A and B were equally strong (planning model M3). Deyle & Slotterback used a quasiexperimental research design to observe and evaluate the mitigation plans and processes in eight Florida counties. Using a pretest-posttest design, their study uncovered higher levels of mutual understanding of planning problems (and of solutions) in counties where community stakeholders were able to directly incorporate their knowledge and ideas to the formal planning deliberations. This finding is significant because strong mutual understanding among stakeholder groups has been shown to generate stronger constituencies for both plan adoption and implementation (Deyle and Slotterback, 2009; Brody, Godshalk, and Burby 2003; Godschalk and Stiftel 1981; Kaiser, Godschalk and Chapin 1995; May et al. 1996).

Pearce (2003) presents the concept of “sustainable hazard mitigation” as the next step for the field of disaster management. In order to achieve sustainable hazard mitigation, Pearce (2003) argues that it is necessary to closely integrate mitigation and participatory community planning. To illustrate her point, Pearce presents a case study of participatory mitigation planning in California’s Portola Valley. Pearce describes Portola Valley’s approach as an example of successful sustainable hazard mitigation in action, exemplified by a high degree of public participation in planning (Pearce, 2003). Based on
the conceptual model of stakeholder participation presented here, Portola Valley applied
the M2b model of public participation.

It is important to note that the participation models are not always contradictory. They can sometimes occur together and complement one another. Moreover, in all of these models, even if participants are heard, it is possible for elements of both types of information and knowledge received by planners through interactions A and B to be lost in the process and not transmitted to the final plan (Innes & Booher, 2007). For example, this can happen as the mitigation planning team filters important information from other stakeholders during the final stages of plan making (interaction D) (Yli-Pelkonen & Kohl, 2005). To address this element of the conceptual framework, this study includes in-depth interviews with mitigation planning team members to assess the impact of “the filter” on participation models and plan quality outcomes.

Conclusion

Under the Stafford Act and DMA 2000 decision makers are required to base hazard mitigation planning decisions not only on adequate technical information from risk assessment studies, but also on the priorities and knowledge of local residents, community stakeholder groups and other stakeholders who can provide information on an area’s vulnerability and experience with previous disasters. A key theme that this study explores is how local knowledge is integrated into planning and decision making.

One of the main propositions of this study is that the engagement of local stakeholders in decision-making and vulnerability assessment is critical to reaching disaster resiliency goals. Although the process of collaborative mitigation planning is
often associated with higher initial costs and extended project timelines, the up-front investment is cost effective when it boils down to effective plan implementation, long-term policy agreements, and safe, resilient communities (Godschalk et al., 1994). Moreover, previous research has found that communicative processes including collaboration, dialogue, and consensus building generate myriad secondary benefits. These benefits include the creation of new forms of knowledge and political capital (Forester, 1999; Innes and Booher, 1999b), increased levels of trust, stronger commitments to plan and policy implementation, and increased social capital and community resilience (Burby, 2003; Innes, 1996; Innes et al., 1994; Creighton, 1992; Wondolleck and Yaffee, 2000; Forester, 1999; Moore, 1995).

Ultimately, the conclusions of this dissertation will have practical significance to local, state and federal planners, emergency managers and policy makers seeking identify ways of improving local citizen participation in hazard mitigation planning. Understanding how participation affects local hazard mitigation plan quality, and how social vulnerability affects participation, will provide important insights into how local hazard mitigation plans can be strengthened to more adequately address the root causes behind increasing vulnerability and risk.
CHAPTER III

METHODS

Introduction

This study examines the relationship between models of participatory planning and local hazard mitigation plan quality and explores the factors that drive variations in plan quality and content. The guiding questions for this research study are:

1) *What is the quality of local hazard mitigation plans created in the northern California Bay-Delta region and to what extent has the public participated in the plan-making process?*

2) *What key relationships exist between local community characteristics, public participation in planning and hazard mitigation plan quality outcomes?*

The following chapter describes the methods by which the data to answer these questions was collected and analyzed. It begins with a description of the selected study area and explains the sample selection process in detail. It then describes the characteristics of participants identified for the interview portion of the study and how they were selected.

The data collection tools used for this research are also described in detail and include the following: the plan quality assessment instrument and protocol, interview guides, and a reflexive journal. A thorough description of the steps involved in data collection is provided and efforts to protect the reliability of findings and the validity of inferences are detailed.
Study Area

The state of California was selected as the location for this study. California is unique in that it has a reputation as a national leader in the mitigation of hazard impacts associated with earthquakes, fires, floods, climate change and other natural disasters. Recently, this reputation has been validated by the U.S. Department of Homeland Security through FEMA. In December of 2007, FEMA designated the 2007 State of California Multi-Hazard Mitigation Plan as an Enhanced State Mitigation Plan. Having an enhanced mitigation plan increases the state’s level of federal hazard mitigation grant funding from 15% to 20% of the total individual and public assistance funds spent by FEMA after each Presidential Disaster Declaration. At the time, only eleven other states had mitigation plans of “enhanced” status. The designation officially distinguishes California’s leadership in reducing the risk of death, injury and property loss from hazards.

The California Emergency Management Agency’s (Cal EMA) Hazard Mitigation Program (HMP) administers the LHMP program for the state. In this role, Cal EMA supports and assists local governments in the development of their LHMPs and heads the review process for all plans before they are forwarded to FEMA for approval. Local governments in California must have an approved LHMP to be eligible for certain mitigation programs authorized under the Stafford Act and, ultimately, the goal of the LHMP program is for all local governments in California to have FEMA-approved LHMPs.

This study focuses specifically on the northern California Bay Area/Delta region of California. This region of northern California provides a particularly information-rich
setting to study how diverse social factors affect local hazard mitigation plan quality. For one, the region is demographically diverse and its levels of social vulnerability vary greatly by county. Moreover, it boasts a diversity of geographic environments. As a result, communities throughout the region are simultaneously managing and planning for a variety of hazard risks.

Examining plans within the selected study area provides an opportunity to evaluate the effects of public participation on plan quality while controlling for state-specific policy factors, regional economics, and climate. Ultimately, the sample location was selected not to ensure comparability among places in different states, but to provide insight into how public participation affects LHMP plan quality in a state that is taking a singularly progressive stance towards disaster risk reduction and planning.

*Sample Selection*

The sample frame for this study consists of all jurisdictions within the study area with completed LHMPs as of July 2011 (including those in the FEMA approval process as of April 2011), totaling 215 jurisdictions. This information was obtained from a list of all local jurisdictions in the state of California with FEMA approved LHMPs (including those plans in the approval pipeline). The list was provided by Cal EMA and is current as of April 2011. There are twelve counties represented in the sample frame. They include

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3 Social vulnerability is commonly calculated using the Social Vulnerability Index (SoVI). SoVI is calculated at the county scale by scoring locations across 11 factors (Cutter et al., 2003).
the nine counties represented by the Association of Bay Area Governments (ABAG) – Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma – and the three delta counties of Placer, Yolo and Sacramento.

Figure 6: Map of California Counties Included in Study Area

The first stage of the sampling strategy was to limit the sample of LHMPs to the community scale by excluding all special districts, tribal entities, and agency jurisdictions. This study focuses specifically on city and county scale jurisdictions because they are the human settlements that are most vulnerable to both rapid- and slow-onset disasters. Not only are cities characterized by high population densities and concentrations of political, economic and social resources, but they are also characterized
by a strong dependency on infrastructure and services. Moreover, rapid urbanization and population growth make it difficult for decision makers and communities to respond quickly and plan for change. As a result, cities are the places where ecological, economic, and social disparities manifest most notably. This research project focuses deliberately on cities because these are the communities that offer the most to learn and the most to gain. By limiting the sample to city-scale hazard mitigation plans, the list of LHMPs was paired down to 98.

Next, the sample of 98 LHMPs was limited to those written for cities with populations between 10,000 and 200,000 people. This paired the sample down further to a total of 71 plans. This population range was chosen for the following reasons: cities with a population of 10,000 or more provide a wider variety of functions and services than do smaller cities and it is believed that large cities, such as San Jose (with a population of 965,000), have very different contextual factors and may skew the sample.

The third stage of the sampling strategy was to limit the sample frame to plans that were available online as of July 1, 2011. Transparency, including the availability of planning documents to the public, has been identified by FEMA as important components for successful loss and vulnerability reduction: An effective and open public involvement process ensures that all citizens understand risks and vulnerabilities so that they will work with the jurisdiction and support policies, actions and tools that over the long-term will lead to a reduction in future losses. Moreover, continued public involvement in the planning process is required by FEMA for LHMP approval. By sampling plans that are available to the general public, this study is effectively evaluating LHMPs from cities that
have met the most basic requirement of the 44 CFR 201.6(c)(4)(iii): the provision of opportunities for continued public involvement in the planning process.

After the three sampling phases, a final sample of 34 LHMPs remained. Table 4 depicts the 34 city plans that were selected for analysis based on the sampling techniques outlined above:

Table 4: Sample Cities

<table>
<thead>
<tr>
<th>County</th>
<th>City</th>
<th>Planning Scale*</th>
<th>Population**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placer</td>
<td>Roseville</td>
<td>SJ</td>
<td>109,497</td>
</tr>
<tr>
<td>Alameda</td>
<td>Berkeley</td>
<td>SJ</td>
<td>100,877</td>
</tr>
<tr>
<td>Napa</td>
<td>Napa</td>
<td>SJ</td>
<td>74,071</td>
</tr>
<tr>
<td>San Mateo</td>
<td>Redwood City</td>
<td>SJ</td>
<td>73,099</td>
</tr>
<tr>
<td>Marin</td>
<td>Mill Valley</td>
<td>SJ</td>
<td>13,189</td>
</tr>
<tr>
<td>Marin</td>
<td>Larkspur</td>
<td>SJ</td>
<td>11,647</td>
</tr>
<tr>
<td>Sonoma</td>
<td>Santa Rosa</td>
<td>MJ-Region</td>
<td>154,017</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Sunnyvale</td>
<td>MJ-Region</td>
<td>130,256</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Santa Clara</td>
<td>MJ-Region</td>
<td>108,075</td>
</tr>
<tr>
<td>Solano</td>
<td>Fairfield</td>
<td>MJ-Region</td>
<td>103,305</td>
</tr>
<tr>
<td>Solano</td>
<td>Vacaville</td>
<td>MJ-Region</td>
<td>91,828</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Gilroy</td>
<td>MJ-Region</td>
<td>48,158</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Campbell</td>
<td>MJ-Region</td>
<td>38,067</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Morgan Hill</td>
<td>MJ-Region</td>
<td>37,099</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Saratoga</td>
<td>MJ-Region</td>
<td>29,974</td>
</tr>
<tr>
<td>Contra Costa</td>
<td>Concord</td>
<td>MJ-Region</td>
<td>120,775</td>
</tr>
<tr>
<td>San Mateo</td>
<td>Burlingame</td>
<td>MJ-Region</td>
<td>27,363</td>
</tr>
</tbody>
</table>
Table 4 (con’t.)

<table>
<thead>
<tr>
<th>County</th>
<th>City</th>
<th>Planning Scale*</th>
<th>Population**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonoma</td>
<td>Windsor</td>
<td>MJ-Region</td>
<td>25,158</td>
</tr>
<tr>
<td>Contra Costa</td>
<td>Orinda</td>
<td>MJ-Region</td>
<td>18,198</td>
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<tr>
<td>San Mateo</td>
<td>Half Moon Bay</td>
<td>MJ-Region</td>
<td>12,271</td>
</tr>
<tr>
<td>Marin</td>
<td>San Anselmo</td>
<td>MJ-Region</td>
<td>11,924</td>
</tr>
<tr>
<td>San Mateo</td>
<td>Hillsborough</td>
<td>MJ-Region</td>
<td>10,651</td>
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<tr>
<td>Sacramento</td>
<td>Elk Grove</td>
<td>MJ-County</td>
<td>130,007</td>
</tr>
<tr>
<td>Sacramento</td>
<td>Citrus Heights</td>
<td>MJ-County</td>
<td>84,269</td>
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<tr>
<td>Sacramento</td>
<td>Folsom</td>
<td>MJ-County</td>
<td>66,399</td>
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<tr>
<td>Yolo</td>
<td>Davis</td>
<td>MJ-County</td>
<td>61,866</td>
</tr>
<tr>
<td>Sacramento</td>
<td>Rancho Cordova</td>
<td>MJ-County</td>
<td>60,008</td>
</tr>
<tr>
<td>Yolo</td>
<td>Woodland</td>
<td>MJ-County</td>
<td>53,069</td>
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<tr>
<td>Placer</td>
<td>Rocklin</td>
<td>MJ-County</td>
<td>51,281</td>
</tr>
<tr>
<td>Yolo</td>
<td>West Sacramento</td>
<td>MJ-County</td>
<td>45,504</td>
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<td>Placer</td>
<td>Lincoln</td>
<td>MJ-County</td>
<td>40,382</td>
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<td>Sacramento</td>
<td>Galt</td>
<td>MJ-County</td>
<td>23,535</td>
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<tr>
<td>Napa</td>
<td>American Canyon</td>
<td>MJ-County</td>
<td>15,943</td>
</tr>
<tr>
<td>Placer</td>
<td>Auburn</td>
<td>MJ-County</td>
<td>13,068</td>
</tr>
</tbody>
</table>

* Data from city LHMP documents
** Data from 2005-2009 American Community Survey 5-year Estimates

Each of the 34 jurisdictions selected have adhered to the participation requirements of the state local hazard mitigation planning mandates, all jurisdictions are vulnerable to threats from natural hazards, and all jurisdictions have prepared updated plans since 2004.
The plan quality of each of the LHMPs listed above was measured using an analysis tool that incorporates hazard mitigation and social vulnerability measures into pre-existing conceptions of what constitutes a high quality plan. Ultimately, based on the results of the plan quality analysis, a select number of cities were chosen for in-depth interviews. The interview methodology and analysis strategies are discussed in detail in Section 3.3.

Data Collection

This dissertation uses both qualitative and quantitative research methods to answer the proposed research questions. Data collection has been broken into three methodological stages leading up to the synthesis of results (Figure 7).

Stage 1 consists of a plan quality evaluation based on a quantitative hazard mitigation plan quality index. Additionally, Stage 1 includes an assessment of public participation models applied during planning for each of the 34 LHMPs. This assessment is based on the four models of public participation explained in the participation framework in Chapter 2.

Stage 2 involves the collection of local community characteristic data from U.S. Census and SHELDUS databases including data on local social vulnerability,
socioeconomics, and hazard exposure. The specific social vulnerability, socioeconomic, and hazard exposure variables were selected based on findings from previous studies related to hazard mitigation plan quality and public participation (Brody, 2003; Berke & French, 1994; Berke, 1996; Cutter et al., 2003; Davis, Cook & Cohen, 2005; Chandra et al., 2010; Birkmann, 2006).

Stand-alone mitigation plans, or LHMPs, are often prepared in the aftermath of a disaster when the sense of crisis leads to a demand for immediate action (Burby, 1998). Although none of the local hazard mitigation plans created in the sample frame were written in direct response to a disaster, hazard exposure (as measured by previous losses from disasters) has been shown to be an important driver of community participation in planning. Sometimes described as “the window of opportunity,” the post disaster period is a time when communities express the greatest levels of public support for hazard mitigation and preparedness activity (Burby, 1998). Moreover, the memories of repeated hazard events prompt some communities to prioritize mitigation planning to a greater extent than communities that may have high hazard risks, but no history of loss.

In addition to hazard exposure, socioeconomic and social vulnerability factors have also been identified as potential constraints (and drivers) of mitigation policies and actions (Ollenburger & Tobin, 1998; Tobin, 1999). Researchers have theorized that socioeconomic and cultural factors can affect attitudes towards mitigation and recovery efforts and that they can act as filters in the hazard mitigation planning system (Tobin, 1999). A principal component analysis has been performed on the selected community characteristic data in order to reduce the many demographic variables to a smaller number of predictor variables (or factors) for use in the regression analysis.
Empirical research has not yet addressed the relationship between socioeconomics, social vulnerability factors and plan quality. Nor has the literature addressed how these contextual factors impact public participation during local hazard mitigation planning. Using SAS software, Stage 2 involves running a number of regression analyses on the community characteristic variables, public participation data and plan quality data. The expectation is that some of these factors may constrain the ability of local communities to participate in local hazard mitigation planning processes. The regression analyses allow me to explore the nature and form and of the relationships between plan quality, participation models and local community characteristics.

Stage 3 includes qualitative, in-depth interviews with organizational and local community stakeholders from the local hazard mitigation planning teams from select cities in the sample frame. Driven by the results of the regression analyses, the detailed case studies were designed to provide a more robust understanding of the dynamics of public participation, plan quality and social vulnerability than is possible from regression analysis or plan quality assessment alone.

Stage 1: Plan Quality Evaluation

In the following sections, the methodological approaches for the three stages of data collection and analysis are described in detail.

Methodology

Building on the methods from previous studies of plan quality, this study measures hazard mitigation plan quality by assessing three equally weighted plan components in a plan quality index: clearly articulated goals, appropriately directed
policies/actions, and a strong factual basis (Brody, 2003; Godschalk, Kaiser, & Berke, 1998; Berke et al., 1998; Godschalk et al., 1999).

Previous research has contributed to the identification of a set of qualitative indicators for each of the three components to create a robust conception of plan quality. In the context of hazard mitigation planning, indicators for the goals component of the plan quality index cover physical impacts of hazards (e.g. assessment of water quality impacts and the preservation of natural areas), economic impacts of hazards (e.g. any goals to equitable distribute hazards management costs and reduce property loss), and impacts on public interests (e.g. any public safety goals or hazard awareness initiatives).

The policy component of plan quality addresses actions associated with increasing community stakeholder awareness of hazards and mitigation, explicit regulatory actions, mitigation incentives, the reduction of structural losses, and recovery concerns.

Previous studies have measured the fact base component of plan quality by assessing the range of background information upon which planning decisions, goals and actions are predicated. In the context of hazard mitigation planning, the range of information includes data about the location and extent of hazard damage, including the magnitude of the hazard event, exposed populations and evacuation clearance times. For the purpose of this study, the fact base component has been augmented to include social vulnerability information. Here, the fact base component includes background data on local demographics, education levels, health services, social services and economy all of which are commonly used indicators of local social vulnerability (Phillips et al., 2009).

Each plan quality indicator was measured on a 0 – 2 ordinal scale. “Zero” (0) is not identified or mentioned, “one” (1) is suggested or identified but not detailed, and
“two” (2) is fully detailed or mandatory in the plan. The scoring methodology for this study is consistent with previous studies and involves assigning equal weights to the indicators of plan quality. In this past this has been done to eliminate the need to make value judgments about which indicator or plan component deserves more emphasis in determining plan quality than others. Moreover, equal weighting has been successful at maintaining consistency in statistical results.

For some components of the plan analysis tool, items have more than one indicator. For example, in the fact base component critical facilities can be either recorded in a list, mapped, or both. In these cases, scores were assessed using an index built by taking the total indicator score and dividing it by the total number of sub-indicators (e.g., if an item received a 1 for mapping and a 1 for listing, the overall score for the item will be 1). This method allows for scores to remain on a scale of 0 to 2 and will favor LHMPs that support their decisions with multiple decision-making tools. To ensure the validity of the plan quality analysis tool and consistency of results, one researcher was tasked with analyzing the entire sample of 34 plans.

Three indices based on the identified plan quality components were created for each LHMP and then aggregated to yield a measure of overall plan quality. This procedure has been carried out previously by planning and hazards researchers including Berke et al. (1996, 1990), Berke & French (1994), and Brody (2003). Steps towards creating the indices for each of the three plan quality components are taken in four stages. First, scores for each indicator is summed within each individual plan component. Second, the sums of these scores are divided by the total possible score for each plan component. Third, in order to put them on a scale of 0 to 10, the fractional plan
component scores are each multiplied by 10. The final step involves the calculation of a total plan quality score for each LHMP by adding the scores of each of the three quality components.

The maximum score for each LHMP is 30. The calculated plan quality component scores for each city’s LHMP, as well as the total plan quality scores, were recorded along with comprehensive community characteristic data for each city.

Assessing Models of Community Participation

In addition to calculating plan quality scores across the three planning components, this study evaluates another key principle of plan quality: local community participation in the planning process. The planning literature broadly defines local community participation as the inclusion of diverse stakeholder interests including local business, advocacy groups, and lay-people in planning and policy making. Because FEMA determines the approval requirements for local hazard mitigation plans this study looks to FEMA as a guide for defining what community participation means in this planning context.

Under DMA 2000, FEMA mandates community participation during local hazard mitigation planning. To help states, local jurisdictions and tribes improve their hazard mitigation planning activities, the agency has developed a set of mitigation planning “how to” guides. The first guide in the series covers topics related to the initiation of a hazard mitigation plan. This guide includes practical tips for assessing community support, building a planning team and engaging local communities.
According to FEMA, one of the first steps towards building a planning team and engaging local communities is determining who the stakeholders are (FEMA, 2002). Here, FEMA defines stakeholders as “individuals or groups that will be affected in any way by a mitigation action or policy” (FEMA, 2002, 2-3). FEMA recommends that stakeholder representation be included from the following groups: neighborhood groups and other non-profit organizations and associations; state, regional, and local government representatives; businesses and development organizations; elected officials; federal agency representatives; academic institutions; and community or state planners (FEMA, 2002). In their how-to guide, FEMA articulates that some of these stakeholders should be included because of their expert and technical knowledge (such as the state, regional, and local government representatives; businesses and development organizations; elected officials; federal agency representatives; and planners), while others should be included so that they can become educated about risk and mitigation issues (neighborhood groups and other non-profit organizations and associations).

For the purpose of this study, organizational stakeholders and technical experts fall under the first category of stakeholder participant, while the second category (meant primarily for educational and consultative purposes) are the local community/citizen stakeholders who live and work within the planning jurisdiction.

Previous studies on participation and plan quality have measured the breadth of community stakeholders involved in planning as an indicator of robust citizen participation. Others have looked at frequency of interaction between organizational and community stakeholders as a barometer for community participation (Brody, 2003; Burby, 2003). For this study, a methodology for assessing models of local community
participation in planning was developed based on a review of previous research on participation and collaborative planning theory. Table 5 combines Arnstein’s (1969) typology of citizen participation with the four conceptual models of community participation in hazard mitigation planning. The table provides a framework for attributing one of four models of community participation to the experiences of local community stakeholders during each of the 34 local hazard mitigation planning process.
Table 5: Models of Community Participation in Hazard Mitigation Planning

<table>
<thead>
<tr>
<th>Model of Community Participation in Hazard Mitigation Planning</th>
<th>Ladder of Citizen Participation</th>
<th>Collaborative Planning Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Manipulation</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Therapy</td>
<td>N/A</td>
</tr>
<tr>
<td>M2</td>
<td>Informing</td>
<td>- Public service announcements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Site visits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Newspapers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Leaflets, brochures, bulletins</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Unstaffed exhibits/displays</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Advertising</td>
</tr>
<tr>
<td></td>
<td>Consultation</td>
<td>- Teleconferencing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Surveys, interviews and questionnaires</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Deliberative polls</td>
</tr>
<tr>
<td></td>
<td>Placation</td>
<td>- Workshops</td>
</tr>
<tr>
<td>M3</td>
<td>Partnership</td>
<td>- Charrettes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Visioning (including virtual)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Consensus conferences</td>
</tr>
<tr>
<td>M4</td>
<td>Delegated Power</td>
<td>- Community advisory committees/liaison groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Community delegated juries</td>
</tr>
<tr>
<td></td>
<td>Community Control</td>
<td>- Community-based data collection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Community power in decision-making and priority setting process</td>
</tr>
</tbody>
</table>

This table is a tool for organizing LHMPs into one of four collaborative planning approaches by identifying the nature of the planning activities that were employed during the local hazard mitigation planning process. Based on the previously established definition of citizen participation, coupled with the conceptual framework outlined above,
a participation model (M1, M2, M3 or M4) was identified for each city’s local hazard mitigation planning process. The models were incorporated into the plan quality dataset along with specific notes describing which community participants were involved in each city’s planning process, how they participated, and why the model was ascribed to the plan.

Stage 2: Principal Component and Regression Analysis

In order to isolate the effects of local community characteristics – namely planning scale, hazard exposure, and social vulnerability – on fact base, plan quality and participation, a select set of variables was collected for analysis. This stage of analysis is designed to identify relationships between planning contexts, hazard exposure, and social vulnerability factors on mitigation plan quality and community participation. Based on social vulnerability analyses conducted by Cutter et al. (2003), and the body of literature on diverse vulnerability assessment models, 20 social vulnerability factors were selected and analyzed. Table 6 outlines the three community characteristic categories and the 20 associated variables selected for this study.
Table 6: Community Characteristic Variables

<table>
<thead>
<tr>
<th>Community Characteristic Category</th>
<th>Variables</th>
</tr>
</thead>
</table>
| Socio-economics                   | Population size*  
|                                   | Race: White*  
|                                   | Race: Black or African American*  
|                                   | Race: American Indian*  
|                                   | Race: Asian*  
|                                   | Race: Native Hawaiian or Pacific Islander*  
|                                   | Race: Hispanic or Latino (of any race)*  
|                                   | Poverty (% total population below poverty)*  
|                                   | Unemployment*  
|                                   | Median household income*  
|                                   | Median home value*  |
| Hazard exposure                   | Total county hazard losses (1990-2010)**  
|                                   | Multi-hazard exposure***  |
| Social vulnerability              | Female-headed household*  
|                                   | % population living in group quarters*  
|                                   | % Population >65*  
|                                   | % Population <14*  
|                                   | Linguistically isolated households*  
|                                   | Educational attainment*  
|                                   | Renter-occupied housing*  |

*Tract level data from the U.S. Census Bureau, American Community Survey 5-year Estimates.

**Data from SHELDUS database. Crop damage plus property damage in 2009 inflation-adjusted U.S. dollars.


The community characteristic data was gathered from the U.S. Census Bureau website portal for the American Community Survey 5-year Estimates and the SHELDUS database. Using SAS, a principal component analysis was performed on community characteristic data included above in order to reduce the many demographic variables to a smaller number of predictor variables for use in the following regression analysis. Four factors (Factors 1, 2, 3, and 4) were extracted and used as independent variables in the regression analysis.
The logistic regression analyses were also performed using SAS software. Table 7 outlines the ten regression models completed for this study. Results are presented in Chapter 4.

Table 7: Summary of Regression Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Dependent Variable</th>
<th>Independent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Plan Quality</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 2</td>
<td>Fact Base Score</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 3</td>
<td>Actions Score</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 4</td>
<td>Goals Score</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 5</td>
<td>Participation</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 6</td>
<td>Plan Quality</td>
<td>Participation</td>
</tr>
<tr>
<td>Model 7</td>
<td>Fact Base</td>
<td>Participation</td>
</tr>
<tr>
<td>Model 8</td>
<td>Actions Score</td>
<td>Participation</td>
</tr>
<tr>
<td>Model 9</td>
<td>Goals Score</td>
<td>Participation</td>
</tr>
<tr>
<td>Model 10</td>
<td>Plan Quality</td>
<td>Planning Scale</td>
</tr>
</tbody>
</table>

Stage 3: Interviews and Qualitative Analysis

In addition to the plan quality assessment and regression analyses, this study includes a set of qualitative, in-depth interviews with participants from local hazard mitigation planning teams. The purpose of the interviews is to gain detail-rich information about local hazard mitigation planning in places where. The data collected from the interviews enable a focused investigation into the results of the previous quantitative analyses.

Interview Sampling Strategy

The case studies for this study focus on layers of interactions, including those between participant groups, cities, and counties. Therefore, it was necessary to make sampling decisions based on each layer of analysis. Key questions include: which cities should be sampled; and which participants should be interviewed from each city?
Initially, the criterion purposive sampling technique was used to select 34 local hazard mitigation plans for the plan quality and participation analysis based on jurisdiction type, population size, and accessibility of LHMP documents. For the interview stage of analysis, sample cities were selected based upon a stratified purposeful sampling approach.

The stratified purposeful sampling approach involves the identification of samples within samples. This means that researchers select particular cases for analysis that vary according to a key a dimension (or dimensions) (Miles & Huberman, 1994). The stratified purposeful sampling approach is meant to illustrate characteristics of particular subgroups of interest and facilitates comparisons between them (Miles & Huberman, 1994). Ultimately, the aim is to capture major variations in a phenomenon rather than a common theme.

Interviewee Selection

The aim of the case studies is to identify key themes related to variations in planning activity. Specifically, the interviews are designed to draw out information related to activity associated with planning actions and fact base. Interviewees were selected from a comprehensive sample of both organizational and local community stakeholders. In this study, organizational stakeholders include technical experts, policy makers and consulting professionals who are directly involved in the local hazard mitigation planning process, either as members of a hazard mitigation planning team or as outside consultants or information providers (Figure 8).
As previously illustrated in Chapter 2, the conceptual framework that guides this study includes a second category of local hazard mitigation planning stakeholder participant: local community/citizen stakeholders. This category of stakeholders includes residents of the jurisdiction for which the plans are being developed, representatives of neighborhood and community special interest groups (school groups, religious groups, environmental organizations, local historic preservation organizations, etc), local advocates, representatives and/or service providers for socially vulnerable groups.

For the interview stage of this study, organizational and local community stakeholder participants were identified by the participant contact information recorded in each local hazard mitigation plan. The saturation sampling technique was used to select interviewees and involved contacting all recorded participants in the planning process, including members of the mitigation planning team as well as outside consultants and community participants.
In addition to identifying the organizational and community participants recorded in the LHMP planning documents it was necessary to identify additional participants who were not official members of the local hazard mitigation planning team, so as to incorporate broad data about local community ideology in the case study analysis. These additional local community participants were identified for interviews using the *snowball* or *chain sampling* technique. Because these participants are particularly difficult to identify through planning documents, their contact information was identified by referral from previous interview subjects.

*Interview Data Collection and Storage*

In-depth interviewees were contacted first through email. Follow up emails were sent to non-respondents seven days after the initial email requesting an interview. In accordance with COMIRB human subjects policy, potential interviewees were not contacted more than three times to schedule an interview.

A general interview guide approach was used for data collection, ensuring that the same general areas of information were collected from each interviewee. This provided a high level of focus for the interviews but also allowed for a degree of flexibility and adaptability during the conversation with the interviewee.

Two interview guides were created for the case study phase of the study, one for organizational participants, and another for local community participants. The interviews were designed to draw out details related to goals, values, challenges and experiences related to the local hazard mitigation planning process in addition to details about the public participation strategies employed during the planning process.
The one-on-one in-depth interviews were conducted via Skype and lasted an average of 30 minutes. The interviews were recorded (unless the interviewee choose not to be recorded, in which case interview responses were recorded by hand) for the purpose of transcription and input into QSR NVivo 9 qualitative coding software.

The information collected during the in-depth interviews was neither sensitive nor potentially damaging; however, because the information is potentially identifiable, confidentiality was an important concern for this study. In order to assure confidentiality for study participants, this research adheres to the following confidentiality procedures:

1. Data has been reported in aggregate and no individuals are identified;
2. No names are used in this report;
3. Instead of reporting about individuals, the analysis focuses on groups of people;
4. Before each interview, participants were informed of the purpose of the research and the interviewer made certain that interviewees were comfortable during the interviews.

Close observance of these procedures assured that informants were able to provide sincere, truthful information about their experiences and about their perspectives.

*Reflexive Journal*

The final data collection technique for this study consists of a reflexive journal made up of field notes. Reflexive journaling allows for researchers to describe their feelings and insights about conducting research while they are moving through the qualitative data collection process (Miles & Huberman, 1994). A reflexive journal serves
as a research audit trail, accounting for what is done at each phase of the research process and why. It contributes to the reliability of the study as well as its internal and external validity. It also provides an additional method for organizing data and emerging ideas.

Data Analysis and Validity

The data collected for this study was analyzed in two stages, one quantitative and one qualitative. The following section described the data analysis procedures in detail.

Plan Quality Analysis

Data collection for the plan quality analysis includes an index-driven scoring procedure based on LHMP content analysis. Once the fact base, goals and actions scores were calculated for each plan, overall plan quality scores were calculated based on the sums of these three components.

This study uses tract level community characteristic data from the U.S. Census Bureau. The hazard exposure data, specifically hazard losses over time and multi-hazard exposure, were collected from SHELDUS database and the State of California’s 2010 Multi-Hazard Mitigation Plan, respectively.

SAS software was used to perform the principal component analysis and reduce the community characteristic variables. The extracted community characteristic factors were then used in multiple regression models in order to validate the plan quality assessment tool and to examine relationships between social vulnerability, plan quality and participation.
Qualitative Interview Analysis

The in-depth, qualitative interviews were conducted over Skype so that the conversations could be recorded and carried out hands-free. Some interviewees did not want their conversations recorded. In these instances, interview notes were taken on paper.

Each of the interviews was transcribed and uploaded into QSR NVivo 9, a qualitative data analysis software tool, for content coding and analysis. A codebook was developed for the purpose of analyzing the interview data. It is described further in Chapter 5.

Validity

Research standards of objectivity and dependability have been maintained to ensure the validity of this study’s results. Consistency of analysis and results were maintained by using the QSR NVivo 9 qualitative data analysis software. The software allows for systemic analysis by organizing and storing data in ways that allow researchers to keep track of intricate relationships, searches, ideas and analysis.

While the plan quality assessment methods have been designed to limit bias and maintain consistency, it is possible that another researcher conducting the same plan quality and participation assessment could turn out different scores. The use of subjectively determined calculations of plan quality and models of participation introduces concerns about bias. For this reason, a pilot test of my plan quality index was conducted on the city of Boulder, Colorado’s, 2010 Local Hazard Mitigation Plan. Additionally, I chose not to enlist additional researchers to score the sample of 34 plans.
as their efforts would introduce further bias to the analysis (Miles & Huberman, 1994; Lincoln & Guba, 1985).

During the data analysis phase of the study the use of member checks and data triangulation contribute to internal validity (Miles & Huberman, 1994). The data triangulation process uses data collected from three different sources: in-depth interviews, plan content evaluation, and a reflexive journal. Table 8 provides an outline of the techniques that will be used in order to ensure the highest quality of data collection and analysis in this research study (Erlandson et al., 1993).

Table 8: Naturalistic Techniques for Ensuring Comprehensive Research Quality

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Conventional Term</th>
<th>Naturalistic Term</th>
<th>Naturalistic Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truth Value</td>
<td>Internal Validity</td>
<td>Credibility</td>
<td>Data triangulation Peer debriefing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Member checks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reflexive journal</td>
</tr>
<tr>
<td>Applicability</td>
<td>External Validity</td>
<td>Transferability</td>
<td>Rich description</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Purposive sampling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reflexive journal</td>
</tr>
<tr>
<td>Consistency</td>
<td>Reliability</td>
<td>Dependability</td>
<td>Data triangulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reflexive journal</td>
</tr>
<tr>
<td>Neutrality</td>
<td>Objectivity</td>
<td>Confirmability</td>
<td>Research audit trail</td>
</tr>
</tbody>
</table>
CHAPTER IV
EVALUATING THE RELATIONSHIPS BETWEEN PARTICIPATION, COMMUNITY CHARACTERISTICS, AND LOCAL HAZARD MITIGATION PLAN QUALITY

Introduction

Although the literature includes a number of studies about public participation in planning and how it affects planning outcomes, there is little empirical research on the relationship between public participation and local hazard mitigation plan quality. The aim of this study, and the analysis of 34 local hazard mitigation plans in the state of California, is to understand how community characteristics and levels of public participation affect mitigation plan quality outcomes.

In this chapter, principal component analysis and regression techniques are used to identify key relationships between local community characteristics and local plan quality scores, to analyze how community characteristics affect levels of public participation in local hazard mitigation planning, and to evaluate how public participation in planning affects local hazard mitigation plan quality. The following chapter outlines the data, methods and results of the quantitative inquiry into plan quality, public participation and local community characteristics.

Methods

Plan Quality Index

Based on a large and comprehensive body of social vulnerability literature, and on guidance provided by previous hazard mitigation plan quality studies, 30 plan quality
variables have been selected for this study’s local hazard mitigation plan quality evaluation index. The Plan Quality Index consists of 30 key indicators that correspond to each of the three principles of plan quality according to theory. The indicators under each principle are designed to assess the degree to which observed plan content corresponds to the overarching principles of plan quality: Fact Base, Goals, and Actions.

Local disaster resilience describes the ability of an individual or community to survive future natural disasters with minimum losses of life and property, as well as the ability to create a greater sense of place among residents, a stronger, more diverse economy, and a more economically integrated and diverse population (Berke & Campanella, 2006; Vale & Campanella, 2005). As a starting point for local resilience building, mitigation planning has great potential to direct hazard avoidance activity and property protection, to foster environmental preservation and sound structural engineering projects, and to develop local awareness about hazards (Schwab and Brower, 2008).

Hazard mitigation activities that fail to address the inherent social vulnerability of a community are unable to remedy the underlying social factors that contribute to weak economies, poor senses of place and community among residents, and meager community coping capacities. Without an adequate understanding of the social components of vulnerability, communities are limited in their ability to envision ways of enhancing their coping capacity and building community resilience. For this reason, it is hypothesized that local hazard mitigation plans of this kind are unable to increase local resilience to disasters because disaster resilience demands a deeper analysis of the risk
equation, one that places a new emphasis on the role of people before, during, and after disasters.

If communities aspire to be resilient in the face of disasters, a better understanding of their own social vulnerability must be developed in addition to a strong understanding of the physical hazards to which they are at risk. Until now, the body of literature has not assessed hazard mitigation plan quality or planning activities as they relate to the engagement with, and incorporation of, local social vulnerability concerns. Moreover, empirical plan quality studies have not addressed the extent to which information about local social vulnerability is included into local hazard mitigation plans or local decision-making.

By entering social vulnerability into the plan quality assessment, we are able to observe whether or not local jurisdictions incorporate contextual social vulnerability information into their hazard mitigation planning strategies to a greater extent than others. The literature review suggests that there will be a positive relationship between highly participatory approaches to hazard mitigation planning and both overall plan quality and Fact Base scores.

In addition to the 30 indicators of plan quality, this study incorporates 20 social vulnerability variables into the Plan Quality Index that reveal the underlying contextual information used to guide hazard mitigation goal setting and policy making for in each of the 34 sample cities. Because the Plan Quality Index includes social vulnerability variables in the Fact Base component, plans that incorporate information about a community’s local social characteristics will attain a higher Fact Base score than those that do not address social dimensions of vulnerability. Table 9 provides a description of
each principle of plan quality, the indicators for their corresponding content, and the scoring criteria used for each indicator.

Table 9: Plan Quality Index

<table>
<thead>
<tr>
<th>Plan quality principle</th>
<th>Indicators</th>
<th>Scoring criteria</th>
</tr>
</thead>
</table>
| Fact Base (jurisdiction-specific social vulnerability) | Minority populations  
|                        | Elderly populations (over 65)                                            | 0 = no information on the item  
|                        | Youth (14 and under)                                                     | 1 = limited information; mentioned, but not detailed  
|                        | People living in group quarters                                          | 2 = detailed information  
|                        | Female-headed households                                                 |                  |
|                        | Linguistically isolated populations                                       |                  |
|                        | Adults with no HS diploma                                                |                  |
|                        | Preschool enrollment                                                     |                  |
|                        | Health services                                                           |                  |
|                        | Disabled population (physically and/or mentally)                         |                  |
|                        | Households below poverty                                                 |                  |
|                        | Households with public assistance income                                 |                  |
|                        | Rental housing                                                            |                  |
|                        | Private and public social service agencies                                |                  |
|                        | Support services to individuals and families that are relevant to disaster response and recovery |                  |
|                        | Voting levels                                                             |                  |
|                        | Housing units with no vehicles available                                  |                  |
|                        | Neighborhood organizations                                                |                  |
|                        | Religious organizations                                                   |                  |
|                        | Special interest groups                                                   |                  |
| Fact Base (physical vulnerability by hazard)                         | Description of hazard location                                           |                  |
|                        | Description of magnitude of hazard                                       |                  |
|                        | Current number of people exposed                                          |                  |
|                        | Number and total value of private infrastructure exposed                  |                  |
|                        | Number and total value of public infrastructure exposed                   |                  |
|                        | Number of different types of critical facilities exposed                  |                  |
|                        | Loss estimations to private structures                                    |                  |
|                        | Loss estimations to public structures                                     |                  |
|                        | Emergency shelter demand and capacity data                               |                  |
|                        | Evacuation clearance time data                                            |                  |
Table 9 (con’t.)

<table>
<thead>
<tr>
<th>Plan quality principle</th>
<th>Indicators</th>
<th>Scoring criteria</th>
</tr>
</thead>
</table>
| Goals (economic impacts)       | Any goal to reduce property loss  
Any goal to minimize fiscal impacts of natural disaster  
Any goal to distribute hazard management costs equitably                                                                                       | 0 = not mentioned in the plan  
1 = mentioned in the plan  
2 = mentioned and detailed in the plan                                                               |
| Goals (physical impacts)       | Any goal to reduce damage to public property  
Any goal to reduce hazard impacts that also achieves preservation of natural resources  
Any goal to reduce hazard impacts that also achieves preservation of open space and recreational areas  
Any goal to reduce hazard impacts that also achieves maintenance of good water quality |                                                                                                    |
| Goals (public interest)        | Any goal to protect population safety  
Any goal to promote a hazards awareness program                                                                                                   |                                                                                                    |
| Actions (general policy)       | Any action/policy to discourage development in hazardous areas  
Any action/policy to connect LHMP to general plan safety element                                                                                   | 0 = not mentioned in the plan  
1 = suggested in the plan  
2 = mandatory in the plan                                                                                 |
| Actions (awareness)            | Any action/policy to promote educational awareness  
Any action/policy for real estate hazard disclosure  
Any action/policy for disaster warning and response programs  
Any action/policy for signage indicating hazardous areas  
Any action/policy for participation in flood insurance programs  
Any action/policy for technical assistance to developers or property owners for mitigation activity |                                                                                                    |
<table>
<thead>
<tr>
<th>Plan quality principle</th>
<th>Indicators</th>
<th>Scoring criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actions (general policy)</td>
<td>Any action/policy to discourage development in hazardous areas &lt;br&gt;Any action/policy to connect LHMP to general plan safety element</td>
<td>0 = not mentioned in the plan &lt;br&gt;1 = suggested in the plan &lt;br&gt;2 = mandatory in the plan</td>
</tr>
<tr>
<td>Actions (awareness)</td>
<td>Any action/policy to promote educational awareness &lt;br&gt;Any action/policy for real estate hazard disclosure &lt;br&gt;Any action/policy for disaster warning and response programs &lt;br&gt;Any action/policy for signage indicating hazardous areas &lt;br&gt;Any action/policy for participation in flood insurance programs &lt;br&gt;Any action/policy for technical assistance to developers or property owners for mitigation activity</td>
<td></td>
</tr>
<tr>
<td>Actions (regulatory)</td>
<td>Any regulatory action/policy involving permits for land use &lt;br&gt;Any regulatory action/policy involving the transfer of development rights &lt;br&gt;Any regulatory action/policy involving cluster development &lt;br&gt;Any regulatory action/policy involving setbacks &lt;br&gt;Any regulatory action/policy involving site plan review &lt;br&gt;Any regulatory action/policy involving special study/impact assessment of development in hazardous areas &lt;br&gt;Any regulatory action/policy involving building standards</td>
<td></td>
</tr>
<tr>
<td>Actions (incentives)</td>
<td>Any incentives involving the retrofitting of private structures &lt;br&gt;Any incentives involving land and property acquisition &lt;br&gt;Any incentives involving tax abatement for mitigation &lt;br&gt;Any density bonus incentives &lt;br&gt;Any incentives involving low interest loans for mitigation activity</td>
<td></td>
</tr>
<tr>
<td>Actions (public facilities and infrastructure)</td>
<td>Any actions/policy involving capital improvement &lt;br&gt;Any actions/policy involving retrofitting public structures &lt;br&gt;Any actions/policy involving critical facilities</td>
<td></td>
</tr>
<tr>
<td>Actions (control of hazards)</td>
<td>Any actions/policy involving storm water management &lt;br&gt;Any actions/policy involving maintenance of structures</td>
<td></td>
</tr>
</tbody>
</table>
Guided by the quantitative Plan Quality Index above, the content of 34 plans was analyzed in terms of their Fact Base, Goals and Actions. Each plan quality indicator is measured on a 0 – 2 ordinal scale. The scoring criterion for the Fact Base component adheres to the following guidelines: 0 = no information on the item; 1 = limited information on the item; mentioned, but not detailed; and 2 = detailed information on the item. The scoring criteria for both the goals and actions components adhere to the following guidelines: 0 = not mentioned in the plan; 1 = mentioned in the plan; and 2 = mentioned and detailed in the plan.

Equal weights were assigned to the variables and components in the Plan Quality Index. This eliminates the need to make value judgments about which indicator or plan...
component deserves more emphasis in determining plan quality than others. Moreover, equal weighting contributes to the maintenance of consistency in statistical results.

A few components of the Plan Quality Index have more than one indicator per variable. For example, under the Fact Base component, critical facilities can be either recorded in a list, mapped, or both. In these cases, scores were assessed using an index built by taking the total indicator score and dividing it by the total number of sub-indicators (for example, if component received a 0 for mapping and a 2 for listing, the overall score for the component will be 2). This method allows for scores to remain on a 0 – to – 2 scale and favors plans that support their decisions with multiple decision-making tools.

Three plan quality component indices were created for each LHMP and then summed to produce a measure of overall plan quality. The indices were developed using a four-step process. First, the scores for each variable were summed within each individual plan component. Second, the sums were divided by the total possible score for each plan component. Third, in order to represent each of the plan quality component scores on a 0 – to – 10 scale, the fractional plan component scores were each multiplied by 10. As a final step, the scores of each of the three quality components were summed to produce a total plan quality score. The maximum plan quality score for each LHMP is 30.

The Plan Quality Index does not evaluate the implementation outcomes of plans, nor does the index measure the success of a plan’s actions and policies in terms of reaching identified goals or reducing local vulnerability. However, empirical research suggests that these successes are positively correlated with high plan quality as measured
by the three indicators assessed by the index (Brody, 2003; Godschalk, Kaiser, & Berke, 1998; Berke et al., 1998; Godschalk et al., 1999).

Methodology for Assessing Models of Community Participation

In addition to the plan quality evaluations, this study includes an assessment of community participation during local hazard mitigation planning. Based on the previously discussed conceptual models of community participation, and Arnstein’s (1969) ladder of citizen participation, specific collaborative planning approaches used by each jurisdiction have been identified and a planning model assigned to each plan ranging from M1 to M4 based on their characteristics.

Table 10 describes each of the collaborative planning approaches that were identified during the plan evaluation phase of this study, the situation of each planning approach along Arnstein’s (1969) hierarchy of public power, and the associated community participation model assigned to each combination of planning approaches.
Table 10: Evaluation Criteria for Models of Community Participation

<table>
<thead>
<tr>
<th>Model of Community Participation in Hazard Mitigation Planning</th>
<th>Hierarchy of Public Power</th>
<th>Collaborative Planning Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Manipulation</td>
<td>- N/A (no public engagement or outreach)</td>
</tr>
<tr>
<td>M2</td>
<td>Informing</td>
<td>- Public service announcements - Site visits - Newspapers - Leaflets, brochures, bulletins - Unstaffed exhibits/displays - Advertising</td>
</tr>
<tr>
<td>M3</td>
<td>Consultation</td>
<td>- Teleconferencing - Surveys, interviews and questionnaires - Deliberative polls - Workshops</td>
</tr>
<tr>
<td>M4</td>
<td>Placation</td>
<td>- Staffed exhibits/displays - Staffed telephone hotlines - Website - Public meeting - Open house (including virtual)</td>
</tr>
<tr>
<td>M5</td>
<td>Partnership</td>
<td>- Charrettes - Visioning (including virtual) - Consensus conferences</td>
</tr>
<tr>
<td>M6</td>
<td>Delegated Power</td>
<td>- Community advisory committees/liaison groups - Community delegated juries</td>
</tr>
<tr>
<td>M7</td>
<td>Community Control</td>
<td>- Community-based data collection - Community power in decision-making and priority setting process</td>
</tr>
</tbody>
</table>

Based on the criteria outlined above, LHMPs that recorded the use of no public participation, or employed strategies that were designed to be manipulative or strictly for therapeutic purposes, have been classified as examples of M1 community participation models. Jurisdictions that carried out informational, consultative participation strategies, including newspaper advertisements, questionnaires and websites were identified as M2 models. Local hazard mitigation planning documents that recorded that they created
community advisory committees or other forms of delegated decision-making groups have been classified as M3 models. M4 models are representative of the highest levels of public power: community control. In these cases, the jurisdiction-specific data collection, priority-setting and decision-making are processes that are fundamentally driven by public stakeholders and local residents.

In some cases the collaborative planning approaches outlined in a jurisdiction’s LHMP span more than one model of community participation. For example, the city of Roseville included questionnaires about perceived hazard risks in resident energy bills (consultation). However, in addition to the surveys they established a hazard mitigation planning steering committee to which members of the public were delegated (delegated power). In cases like this, a public participation model was assigned based on the collaborative planning approach that afforded citizens the highest level of power. Therefore, Roseville’s plan was assigned the M3 model.

This evaluation method was chosen because it rewards jurisdictions for undertaking multiple approaches to collaboration and outreach. Moreover, it acknowledges previous empirical research that has found that the total number of community engagement techniques used during planning has a significant positive correlation with the total number of stakeholders involved in planning processes (Brody et al., 2003; Stevens, Berke & Song, 2010).

Before the 34 selected local hazard mitigation plans were evaluated, the feasibility of the Plan Quality Index was tested and community participation model evaluation criteria on the City of Boulder, Colorado’s, 2010 Local Hazard Mitigation Plan. Fact Base, Goals and Actions of Boulder’s plan were rated according to the Plan Quality
Index. The pilot test was primarily concerned with solidifying the scoring criteria for each variable and careful attention was given to the specific scoring choices that were made based on the wording of actions and goals. By using the index to determine the quality of Boulder’s LHMP, as well as the community participation model used to produce the plan, the scoring procedures for the index were refined so as to validate the consistency of results.

Data

The following section presents the data used for the quantitative portion of this study including plan quality data, data showing levels of public participation in planning and local community characteristic data.

*Plan Quality and Levels of Public Participation*

The Plan Quality Index discussed in Chapter 3 was used as a tool for assessing local hazard mitigation plans from 34 cities in the California bay and delta region. Each plan was individually scored, starting with Fact Base variables, followed by Goals variables, and concluding with Actions variables. The scores of the three components have been summed to provide an overall plan quality score for each of the 34 plans. At the conclusion of each plan content analysis, community participation models were identified for each city.

Table 11 summarizes the plan quality scores of each of the 34 cities in the sample frame. The table also provides results of the participation evaluation and information about the Planning Scale of each local hazard mitigation plan.
Table 11. Cities Ranked by Plan Quality Score

<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
<th>Plan Scale</th>
<th>Participation Model</th>
<th>Fact Base Score</th>
<th>Goals Score</th>
<th>Actions Score</th>
<th>Plan Quality Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roseville</td>
<td>Placer</td>
<td>SJ</td>
<td>M3</td>
<td>4.31</td>
<td>5.55</td>
<td>3.37</td>
<td>13.25</td>
</tr>
<tr>
<td>Napa</td>
<td>Napa</td>
<td>SJ</td>
<td>M3</td>
<td>3.33</td>
<td>5.55</td>
<td>4.19</td>
<td>13.08</td>
</tr>
<tr>
<td>Elk Grove</td>
<td>Sacramento</td>
<td>MJ</td>
<td>M3</td>
<td>2.00</td>
<td>6.11</td>
<td>2.29</td>
<td>10.41</td>
</tr>
<tr>
<td>Redwood City</td>
<td>San Mateo</td>
<td>SJ</td>
<td>M2</td>
<td>1.70</td>
<td>5.55</td>
<td>2.43</td>
<td>9.69</td>
</tr>
<tr>
<td>Berkeley</td>
<td>Alameda</td>
<td>SJ</td>
<td>M2</td>
<td>1.62</td>
<td>4.44</td>
<td>2.97</td>
<td>9.04</td>
</tr>
<tr>
<td>Mill Valley</td>
<td>Marin</td>
<td>SJ</td>
<td>M2</td>
<td>1.72</td>
<td>5.00</td>
<td>2.29</td>
<td>9.02</td>
</tr>
<tr>
<td>Woodland</td>
<td>Yolo</td>
<td>MJ</td>
<td>M2</td>
<td>2.16</td>
<td>5.55</td>
<td>1.21</td>
<td>8.93</td>
</tr>
<tr>
<td>Windsor</td>
<td>Sonoma</td>
<td>MJ</td>
<td>M2</td>
<td>0.45</td>
<td>5.55</td>
<td>2.29</td>
<td>8.31</td>
</tr>
<tr>
<td>Citrus Heights</td>
<td>Sacramento</td>
<td>MJ</td>
<td>M2</td>
<td>2.00</td>
<td>4.44</td>
<td>1.75</td>
<td>8.20</td>
</tr>
<tr>
<td>Lincoln</td>
<td>Placer</td>
<td>MJ</td>
<td>M2</td>
<td>0.94</td>
<td>5.55</td>
<td>1.62</td>
<td>8.12</td>
</tr>
<tr>
<td>Larkspur</td>
<td>Marin</td>
<td>SJ</td>
<td>M2</td>
<td>1.37</td>
<td>3.88</td>
<td>2.70</td>
<td>7.96</td>
</tr>
<tr>
<td>Davis</td>
<td>Yolo</td>
<td>MJ</td>
<td>M2</td>
<td>1.16</td>
<td>5.55</td>
<td>1.21</td>
<td>7.93</td>
</tr>
<tr>
<td>Rocklin</td>
<td>Placer</td>
<td>MJ</td>
<td>M2</td>
<td>0.94</td>
<td>5.55</td>
<td>0.94</td>
<td>7.44</td>
</tr>
<tr>
<td>American Canyon</td>
<td>Napa</td>
<td>MJ</td>
<td>M2</td>
<td>0.88</td>
<td>5.55</td>
<td>0.94</td>
<td>7.39</td>
</tr>
<tr>
<td>Folsom</td>
<td>Sacramento</td>
<td>MJ</td>
<td>M3</td>
<td>1.55</td>
<td>3.33</td>
<td>2.43</td>
<td>7.32</td>
</tr>
<tr>
<td>West Sacramento</td>
<td>Yolo</td>
<td>MJ</td>
<td>M2</td>
<td>0.16</td>
<td>6.66</td>
<td>0.40</td>
<td>7.23</td>
</tr>
<tr>
<td>Auburn</td>
<td>Placer</td>
<td>MJ</td>
<td>M2</td>
<td>0.66</td>
<td>5.55</td>
<td>0.94</td>
<td>7.16</td>
</tr>
<tr>
<td>Orinda</td>
<td>Contra Costa</td>
<td>MJ</td>
<td>M2</td>
<td>1.00</td>
<td>2.77</td>
<td>3.24</td>
<td>7.02</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Santa Clara</td>
<td>MJ</td>
<td>M2</td>
<td>1.12</td>
<td>2.77</td>
<td>2.29</td>
<td>6.20</td>
</tr>
<tr>
<td>Half Moon Bay</td>
<td>San Mateo</td>
<td>MJ</td>
<td>M2</td>
<td>0.66</td>
<td>2.77</td>
<td>2.56</td>
<td>6.01</td>
</tr>
<tr>
<td>Vacaville</td>
<td>Solano</td>
<td>MJ</td>
<td>M2</td>
<td>0.66</td>
<td>2.77</td>
<td>2.56</td>
<td>6.01</td>
</tr>
<tr>
<td>Sunnyvale</td>
<td>Santa Clara</td>
<td>MJ</td>
<td>M2</td>
<td>1.16</td>
<td>2.77</td>
<td>2.02</td>
<td>5.97</td>
</tr>
</tbody>
</table>
Table 11 (con’t.)

<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
<th>Plan Scale</th>
<th>Participation Model</th>
<th>Fact Base Score</th>
<th>Goals Score</th>
<th>Actions Score</th>
<th>Plan Quality Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Rosa</td>
<td>Sonoma</td>
<td>MJ</td>
<td>M2</td>
<td>0.83</td>
<td>2.77</td>
<td>2.16</td>
<td>5.77</td>
</tr>
<tr>
<td>San Anselmo</td>
<td>Marin</td>
<td>MJ</td>
<td>M2</td>
<td>0.50</td>
<td>2.77</td>
<td>2.29</td>
<td>5.57</td>
</tr>
<tr>
<td>Fairfield</td>
<td>Solano</td>
<td>MJ</td>
<td>M2</td>
<td>0.69</td>
<td>2.77</td>
<td>2.02</td>
<td>5.44</td>
</tr>
<tr>
<td>Gilroy</td>
<td>Santa Clara</td>
<td>MJ</td>
<td>M2</td>
<td>1.16</td>
<td>2.77</td>
<td>1.48</td>
<td>5.43</td>
</tr>
<tr>
<td>Campbell</td>
<td>Santa Clara</td>
<td>MJ</td>
<td>M2</td>
<td>1.08</td>
<td>2.77</td>
<td>1.48</td>
<td>5.34</td>
</tr>
<tr>
<td>Burlingame</td>
<td>San Mateo</td>
<td>MJ</td>
<td>M2</td>
<td>0.50</td>
<td>2.77</td>
<td>1.83</td>
<td>5.11</td>
</tr>
<tr>
<td>Concord</td>
<td>Contra Costa</td>
<td>MJ</td>
<td>M2</td>
<td>0.58</td>
<td>2.77</td>
<td>1.62</td>
<td>4.98</td>
</tr>
<tr>
<td>Saratoga</td>
<td>Santa Clara</td>
<td>MJ</td>
<td>M2</td>
<td>1.16</td>
<td>2.77</td>
<td>0.81</td>
<td>4.75</td>
</tr>
<tr>
<td>Hillsborough</td>
<td>San Mateo</td>
<td>MJ</td>
<td>M2</td>
<td>0.50</td>
<td>2.77</td>
<td>1.35</td>
<td>4.62</td>
</tr>
<tr>
<td>Galt</td>
<td>Sacramento</td>
<td>MJ</td>
<td>M3</td>
<td>0.83</td>
<td>2.77</td>
<td>0.81</td>
<td>4.42</td>
</tr>
<tr>
<td>Rancho Cordova</td>
<td>Sacramento</td>
<td>MJ</td>
<td>M3</td>
<td>0.66</td>
<td>1.66</td>
<td>0.27</td>
<td>2.60</td>
</tr>
<tr>
<td>Morgan Hill</td>
<td>Santa Clara</td>
<td>MJ</td>
<td>M1</td>
<td>0.66</td>
<td>0.00</td>
<td>0.13</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Out of a total possible score of 30 points, the City of Roseville’s plan has the highest overall Plan Quality Score (13.25) while the City of Morgan Hill has the lowest composite Plan Quality Score (0.802). Out of a total possible score of 10 points, the Fact Base Scores for the thirty-four local hazard mitigation plans range from 0.167 (the City of West Sacramento) to 4.315 (the City of Roseville). The Goals Scores range from 0 on the low end (the City of Morgan Hill articulated no goals in their local hazard mitigation plan) and 6.67 on the high end (the City of West Sacramento). The Action Scores range
from 0.14 (the City of Morgan Hill) to 4.19 (the City of Napa). Below, Table 12 summarizes the descriptive statistics from the plan content analysis.

Table 12: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Analysis N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fact Base Score</td>
<td>1.20</td>
<td>.84</td>
<td>34</td>
</tr>
<tr>
<td>Goals Score</td>
<td>3.79</td>
<td>1.58</td>
<td>34</td>
</tr>
<tr>
<td>Actions Score</td>
<td>1.95</td>
<td>1.12</td>
<td>34</td>
</tr>
<tr>
<td>Plan Quality Score</td>
<td>6.76</td>
<td>2.59</td>
<td>34</td>
</tr>
</tbody>
</table>

Research standards of objectivity and dependability were paramount during project design and data collection in order to ensure the validity of the plan quality analysis tool and consistency of results. Although we strive to remain objective, it is inevitable that researchers own biases are introduced into the scoring and content analysis of each plan. For this reason, a pilot test of the Plan Quality Index was conducted on the city of Boulder, Colorado’s 2010 Local Hazard Mitigation Plan. Additionally, additional researchers were not enlisted to assist with the plan quality assessment in order to avoid introducing additional bias into the analysis (Miles & Huberman, 1994; Lincoln & Guba, 1985).

There are a few limitations to the Plan Quality data in this study. One limitation is the small sample size. Because there are only 34 plans included in the study the findings cannot be generalized to the broader community based on the results of this study alone. In addition, out of the sample of thirty-four plans there are only seven plans that qualify as having highly participatory planning models. In a perfect world, a large number of cases would have been available to put through the principal components and regression analyses carried out in this phase of the study.
Despite these limitations, the results of the following quantitative analyses contribute to new understandings of the local hazard mitigation planning process, which is significant considering that the sample region is characterized as an example of best practices in planning and participation at both the state and local-jurisdiction scale. Moreover, despite the smaller than ideal sample size, the results of the quantitative analyses provoke new questions about the relationship between community characteristics, plan quality, and public participation in hazard mitigation planning.

Community Characteristic Data

In addition to the plan quality assessment, data for twenty contextual variables were collected across three core categories of hazard vulnerability: socio-economics, hazard exposure and social vulnerability. Nineteen of those twenty community characteristics variables were selected from a comprehensive set of social vulnerability indicators previously identified by Cutter et al. (2003). In their study, Social Vulnerability to Environmental Hazards, Cutter et al. (2003) identifies a series of composite factors that differentiate U.S. communities according to their relative levels of social vulnerability. Not only do these factors illustrate geographic variability in social vulnerability, but they also illustrate variations in underlying causes of vulnerability. Although Cutter et al. (2003) collected and analyzed social vulnerability factors at the county scale, the core indicators are still relevant and applicable to vulnerability science at the city scale. The factors identified in Cutter et al.’s statistical analysis are consistent with the broader hazards and disaster literature.
Table 13 outlines the community characteristic categories and the twenty associated variables selected for this study.

Table 13: Community Characteristic Variables

<table>
<thead>
<tr>
<th>Community Characteristics</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-economics</td>
<td>Population size, Race: White, Race: African American or African American, Race: American Indian or Alaskan Native, Race: Asian, Race: Native Hawaiian or Pacific Islander, Race: Hispanic or Latino (of any race), Poverty (% total population below poverty), Unemployment, Median household income, Median home value</td>
</tr>
<tr>
<td>Hazard exposure</td>
<td>Total county hazard losses (1990-2010), Multi-hazard exposure</td>
</tr>
<tr>
<td>Social vulnerability</td>
<td>Female-headed household, % population living in group quarters, % Population &gt; 65, % Population &lt; 14, Linguistically isolated households, Educational attainment, Renter-occupied housing</td>
</tr>
</tbody>
</table>

The selected socio-economics variables paint a comprehensive picture of the social and economic character of each of the 34 cities included in the sample frame. The data for these variables is derived from the U.S. Census Bureau’s 2005-2009 American Community Survey (5-year estimates). This dataset was selected for a number of reasons. First, the ACS 5-year estimates are based on data collected between January 2005 and December 2009 and represent average community characteristics over the five-year
period of time. This range of data is appropriate for this study because the median adoption year of the sample of thirty-four local hazard mitigation plans is 2009.

In addition, the 2005-2009 ACS 5-year estimates are published for small geographic areas and are available for areas with populations less than 20,000 people. The sample of cities in this study contains communities with populations between 10,000 and 200,000. Finally, although the estimates are less current than the 1-year and 3-year estimates, the 5-year estimates are based on a larger sample size.

Although none of the local hazard mitigation plans created in the sample frame were written in direct response to a disaster, hazard exposure has been shown to be an important driver of community participation in planning. Catastrophes and disasters have been shown to open “windows of opportunity,” however briefly, that can catalyze change with respect to local priorities, policy and practice related to emergency management. These changes often include greater levels of public support for hazard mitigation and preparedness activity (Godschalk et al., 1999; Smith, 2010; Berke & Campanella, 2006; Burby, 2008). Additionally, the memories of repeated hazard events can prompt some communities to prioritize mitigation planning to a greater extent than communities that may have high hazard risks, but little to no history of loss.

Data about previous hazard losses and exposure to hazards is included in the set of community characteristic variables in order to account for the effect of previous hazards on communities within the sample frame. The local hazard exposure level of the
thirty-four sample cities is determined by coupling two distinct variables: *total monetary losses from hazards by county between 1990 and 2010* and *multi-hazard exposure*. The total monetary loss data can be found on the SHELDUS database. Values represent county-scale crop damage plus property damage in U.S. 2009 inflation-adjusted dollars.

The multi-hazard exposure data was collected from California’s 2010 State Hazard Mitigation Plan (SHMP). In 2007, a GIS-based risk exposure analysis was conducted by California Polytechnic State University, San Luis Obispo, for the California Emergency Management Agency’s State Hazard Mitigation Planning efforts. Multi-hazard exposure data was collected for the three primary hazards that threaten California – floods, earthquakes, and wildfires. Based on the risk exposure data, a series of GIS maps were created for California’s 2007 State Hazard Mitigation Plan (SHMP) to display the exposure of the state’s 58 counties to these three hazards.

For the purpose of comparability, the relative hazard exposure of each county is ranked on a scale from high, to medium, to low. The exposure maps use three colors to symbolize the relative vulnerability of California counties to hazards (see Figure 9). The map has been used to guide planning decisions during California State mitigation planning efforts.  

---

4 Source: HVRI’s SHELDUS database  
5 Source: State of California 2010 Hazard Mitigation Plan
Figure 9: California State Hazard Exposure Map

Information from 2010 California State Hazard Mitigation Plan multi-hazard exposure maps has been incorporated as one of the local community characteristic variables. Table 14 outlines the descriptive statistics associated with hazard exposure data in Northern California Bay-Delta region.

Table 14: Descriptive Statistics for Hazard Exposure Data

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Analysis N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-hazard exposure</td>
<td>1.79</td>
<td>.41</td>
<td>34</td>
</tr>
<tr>
<td>Hazard Losses (U.S. $)</td>
<td>$269 million</td>
<td>$464 million</td>
<td>34</td>
</tr>
</tbody>
</table>
Based on data from the 2010 California State Hazard Mitigation Plan, the majority of the cities in the sample frame lie in counties characterized by medium to low levels of multi-hazard exposure. Although the communities are currently planning for a wide variety of hazard risks, there is little variation between communities in terms of their relative levels of hazard exposure. All of the cities in the sample frame are characterized by medium levels of hazard exposure except for cities located in Placer and Yolo counties (Auburn, Davis, Lincoln, Rocklin, West Sacramento, Woodland and Roseville), which have low levels of hazard exposure. Table 15 summarizes the exposure and hazard loss data by city and county.

Table 15: Summary of Multi-Hazard Exposure and Losses by City

<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
<th>Exposure</th>
<th>Total Hazard Losses by County (1990-2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morgan Hill city, California</td>
<td>Santa Clara</td>
<td>2</td>
<td>&lt; $100 million</td>
</tr>
<tr>
<td>American Canyon city, California</td>
<td>Napa County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Auburn city, California</td>
<td>Placer County</td>
<td>1</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Berkeley city, California</td>
<td>Alameda</td>
<td>2</td>
<td>&gt; $1 billion</td>
</tr>
<tr>
<td>Burlingame city, California</td>
<td>San Mateo</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
</tbody>
</table>
Table 15 (con’t.)

<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
<th>Exposure</th>
<th>Total Hazard Losses by County (1990-2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campbell city, California</td>
<td>Santa Clara</td>
<td>2</td>
<td>&lt; $100 million</td>
</tr>
<tr>
<td>Concord city, California</td>
<td>Contra Costa</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Davis city, California</td>
<td>Yolo County</td>
<td>1</td>
<td>&lt; $100 million</td>
</tr>
<tr>
<td>Fairfield city, California</td>
<td>Solano County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Gilroy city, California</td>
<td>Santa Clara</td>
<td>2</td>
<td>&lt; $100 million</td>
</tr>
<tr>
<td>Half Moon Bay city, California</td>
<td>San Mateo</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Hillsborough town, California</td>
<td>San Mateo</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Larkspur city, California</td>
<td>Marin County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Lincoln city, California</td>
<td>Placer County</td>
<td>1</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Mill Valley city, California</td>
<td>Marin County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Napa city, California</td>
<td>Napa County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Orinda city, California</td>
<td>Contra Costa</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Redwood City city, California</td>
<td>San Mateo</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Rocklin city, California</td>
<td>Placer County</td>
<td>1</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>San Anselmo town, California</td>
<td>Marin County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Santa Clara city, California</td>
<td>Santa Clara</td>
<td>2</td>
<td>&lt; $100 million</td>
</tr>
<tr>
<td>Santa Rosa city, California</td>
<td>Sonoma County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Saratoga city, California</td>
<td>Santa Clara</td>
<td>2</td>
<td>&lt; $100 million</td>
</tr>
<tr>
<td>Sunnyvale city, California</td>
<td>Santa Clara</td>
<td>2</td>
<td>&lt; $100 million</td>
</tr>
<tr>
<td>Vacaville city, California</td>
<td>Solano County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
</tbody>
</table>
Table 15 (con’t.)

<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
<th>Exposure</th>
<th>Total Hazard Losses by County (1990-2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Sacramento city, Calif.</td>
<td>Yolo County</td>
<td>1</td>
<td>&lt; $100 million</td>
</tr>
<tr>
<td>Woodland city, Calif.</td>
<td>Yolo County</td>
<td>1</td>
<td>&lt; $100 million</td>
</tr>
<tr>
<td>Citrus Heights city, Calif.</td>
<td>Sacramento County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Elk Grove city, Calif.</td>
<td>Sacramento County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Folsom city, Calif.</td>
<td>Sacramento County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Galt city, Calif.</td>
<td>Sacramento County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Rancho Cordova city, Calif.</td>
<td>Sacramento County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Roseville city, Calif.</td>
<td>Placer County</td>
<td>1</td>
<td>$100 - $500 million</td>
</tr>
<tr>
<td>Windsor town, Calif.</td>
<td>Sonoma County</td>
<td>2</td>
<td>$100 - $500 million</td>
</tr>
</tbody>
</table>

Because there was very little variation between communities in terms of their previous hazard losses and exposure, the data listed in the table above was removed from the principal component analysis and the regression analysis. The data listed Below, Table 16 summarizes the eighteen community characteristic variables that were compiled for quantitative data analysis.
Table 16: Summary of Community Characteristic Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDIAN HOUSEHOLD INCOME</td>
<td>Median household income in past 12 months*</td>
<td>Continuous</td>
<td>None (value in 2009 inflation-adjusted dollars)</td>
</tr>
<tr>
<td>POPULATION SIZE</td>
<td>Total population size of incorporated place (city or town)*</td>
<td>Continuous</td>
<td>None</td>
</tr>
<tr>
<td>POVERTY</td>
<td>% of total population with income in the last 12 months below poverty level*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>MEDIAN HOME VALUE</td>
<td>Median home value*</td>
<td>Continuous</td>
<td>None (value in dollars)</td>
</tr>
<tr>
<td>POPULATION IN GROUP QUARTERS</td>
<td>% of total population living in a group living arrangement, managed/owned by an entity or organization providing housing and/or services for residents*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>HOUSING TENURE</td>
<td>% of total housing that is renter-occupied*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
</tbody>
</table>
Table 16 (con’t.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 YEARS &amp; OLDER</td>
<td>% of total population that is 65 years old or older*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>14 YEARS &amp; YOUNGER</td>
<td>% of total population that is 14 years old or younger*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>RACE: WHITE</td>
<td>% of total population that is White*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>RACE: AFRICAN AMERICAN OR AFRICAN AMERICAN</td>
<td>% of total population that is African American or African American*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>RACE: ASIAN</td>
<td>% of total population that is Asian*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>RACE: HISPANIC OR LATINO</td>
<td>% of total population that is Hispanic or Latino (of any race)*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>NATIVE HAWAIIAN AND OTHER PACIFIC ISLANDER</td>
<td>% of total population that is Native Hawaiian or other Pacific Islander</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>AMERICAN INDIAN OR ALASKAN NATIVE</td>
<td>% of total population that is American Indian or Alaskan Native</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>FEMALE HOUSEHOLDERS</td>
<td>% of total population made up of females maintaining a household with no husband of the householder present*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>UNEMPLOYMENT</td>
<td>% unemployment rate for population 16 years and older*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>LOW EDUCATIONAL ATTAINMENT</td>
<td>% of total population over 25 years old with less than a high school diploma*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>LINGUISTIC ISOLATION</td>
<td>% of total households that are linguistically isolated (aggregate of Spanish, indo-euro, Asian and pacific, and other)*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
</tbody>
</table>

*Tract level data from the U.S. Census Bureau, American Community Survey 5-year estimates.
Data Reduction Using Principal Components Analysis

Research question number two asks: *How do community characteristics and levels of public participation affect mitigation plan quality outcomes?* This question drives the quantitative analysis portion of this study, which is designed to address the following three aims:

- **Aim 1**: To identify key relationships between local community characteristics and local plan quality scores;
- **Aim 2**: To analyze how community characteristics affect levels of public participation in local hazard mitigation planning; and
- **Aim 3**: To evaluate how public participation in planning affects local hazard mitigation plan quality

During the process of identifying the key relationships outlined in the three aims above, we develop a stronger understanding of how community characteristics and levels of public participation affect mitigation plan quality outcomes. The following sections describe the data normalization techniques used to prepare the community characteristic data for the principal components analysis and describes the set of factors that were extracted during the data reduction process.

**Principal Components Analysis**

Principal components analysis (PCA) is a method used for estimating relationships among sets of variables. Although PCA does not create new information, it is useful because it organizes and summarizes information in ways that uncover unseen, latent variables that are reflected in a set of observable variables.
PCA is a statistical technique that is used to replace a large set of variables (such as the community characteristic variables collected for this study) by a smaller set of variables which is the best representation of the larger set. The technique allows for a set of correlated explanatory variables to be transformed into a new set of uncorrelated variables called principal components (or factors). The principal components are all linear combinations of the original correlated variables and can be used in place of the original variables.

Table 17 summarizes the descriptive statistics for the set of eighteen community characteristic variables included in the PCA.

Table 17: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Analysis N</th>
</tr>
</thead>
<tbody>
<tr>
<td>POPULATION SIZE</td>
<td>58671.47</td>
<td>41360.68</td>
<td>34</td>
</tr>
<tr>
<td>UNEMPLOYMENT</td>
<td>6.58</td>
<td>1.60</td>
<td>34</td>
</tr>
<tr>
<td>MEDIAN HOUSEHOLD INCOME (U.S. $)</td>
<td>$81,718</td>
<td>$31,365</td>
<td>34</td>
</tr>
<tr>
<td>POVERTY</td>
<td>8.74</td>
<td>5.15</td>
<td>34</td>
</tr>
<tr>
<td>LOW EDUCATIONAL ATTAINMENT</td>
<td>11.31</td>
<td>6.49</td>
<td>34</td>
</tr>
<tr>
<td>LINGUISTIC ISOLATION</td>
<td>6.46</td>
<td>4.07</td>
<td>34</td>
</tr>
<tr>
<td>14 YEARS &amp; YOUNGER</td>
<td>20.09</td>
<td>3.25</td>
<td>34</td>
</tr>
<tr>
<td>65 YEARS &amp; OLDER</td>
<td>13.06</td>
<td>4.27</td>
<td>34</td>
</tr>
<tr>
<td>RACE: WHITE</td>
<td>67.41</td>
<td>13.81</td>
<td>34</td>
</tr>
<tr>
<td>RACE: AFRICAN AMERICAN OR AFRICAN AMERICAN</td>
<td>3.48</td>
<td>3.80</td>
<td>34</td>
</tr>
<tr>
<td>RACE: ASIAN</td>
<td>13.42</td>
<td>11.43</td>
<td>34</td>
</tr>
<tr>
<td>RACE: HISPANIC OR LATINO</td>
<td>21.49</td>
<td>13.51</td>
<td>34</td>
</tr>
<tr>
<td>RACE: AMERICAN INDIAN OR ALASKAN NATIVE</td>
<td>0.37</td>
<td>0.50</td>
<td>34</td>
</tr>
</tbody>
</table>
Collinearity between variables is an important concern when incorporating predictor variables into a multiple regression analysis. Collinearity is defined as correlation among the predictor variables and it often occurs with regional data where different variables (e.g. unemployment, poverty, median income) tend to rise and fall together. Collinearity is a concern when performing a multiple regression analysis because the redundancy of correlation entangles the effects of the predictors which complicates the interpretation of results.

The results of a multiple regression analysis can be problematic if the independent variables are highly correlated. The PCA technique is the most practical technique for solving this problem. In order to regulate collinearity between the community characteristic variables a number of variables were tested for collinearity based on theory. Because the economic variables unemployment, poverty, and median household income are likely to predict one another, the variables were eliminated from the PCA. The total variance (or factor groupings) from the PCA run without the economic variables did not
differ from the results of the run with the variables included. Ultimately, none of the three economic variables were eliminated due to their negligible effect on the results of the PCA.

Eighteen of the twenty originally identified community characteristic variables were included in the PCA analysis. Table 18 summarizes the variables included in the PCA.

Table 18: Summary of PCA Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDIAN HOUSEHOLD INCOME</td>
<td>Median household income in past 12 months*</td>
<td>Continuous</td>
<td>None (value in 2009 inflation-adjusted dollars)</td>
</tr>
<tr>
<td>POPULATION SIZE</td>
<td>Total population size of incorporated place (city or town)*</td>
<td>Continuous</td>
<td>None</td>
</tr>
<tr>
<td>POVERTY</td>
<td>% of total population with income in the last 12 months below poverty level*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>MEDIAN HOME VALUE</td>
<td>Median home value*</td>
<td>Continuous</td>
<td>None (value in dollars)</td>
</tr>
<tr>
<td>POPULATION IN GROUP QUARTERS</td>
<td>% of total population living in a group living arrangement, managed/owned by an entity or organization providing housing and/or services for residents*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>HOUSING TENURE</td>
<td>% of total housing that is renter-occupied*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
<td>Type</td>
<td>Coding</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>65 YEARS &amp; OLDER</td>
<td>% of total population that is 65 years old or older*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>14 YEARS &amp; YOUNGER</td>
<td>% of total population that is 14 years old or younger*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>RACE: WHITE</td>
<td>% of total population that is White*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>RACE: AFRICAN AMERICAN</td>
<td>% of total population that is African American*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>RACE: ASIAN</td>
<td>% of total population that is Asian*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>RACE: HISPANIC OR LATINO</td>
<td>% of total population that is Hispanic or Latino (of any race)*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>NATIVE HAWAIIAN AND OTHER PACIFIC ISLANDER</td>
<td>% of total population that is Native Hawaiian or other Pacific Islander</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>AMERICAN INDIAN OR ALASKAN NATIVE</td>
<td>% of total population that is American Indian or Alaskan Native</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>FEMALE HOUSEHOLDERS</td>
<td>% of total population made up of females maintaining a household with no husband of the householder present*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>UNEMPLOYMENT</td>
<td>% unemployment rate for population 16 years and older*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>LOW EDUCATIONAL ATTAINMENT</td>
<td>% of total population over 25 years old with less than a high school diploma*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
<tr>
<td>LINGUISTIC ISOLATION</td>
<td>% of total households that are linguistically isolated (aggregate of Spanish, indoeuro, Asian and pacific, and other)*</td>
<td>Continuous</td>
<td>Percentage (0.00 to 1.00)</td>
</tr>
</tbody>
</table>
As a final data management step, Z score transformations were created to normalize the community characteristic variables. By creating Z scores, all of the variables have a mean of zero and a standard deviation of one.

Before running the Principal Component extraction procedure, the SAS software was asked to retain as many factors as there were eigenvalues greater than 1. To begin, a PCA model was run with no rotation. An additional PCA was run with a Varimax rotation. The results of the two models were quite similar with respect to the number of factors extracted and the factor loading scores (Table 19). Both runs yielded four factors with a total variance of 78%.

Table 19: Principal Component Analysis Runs

<table>
<thead>
<tr>
<th>Run</th>
<th>Method</th>
<th>Rotation</th>
<th># of Factors</th>
<th>Total % Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Principal Components Analysis</td>
<td>None</td>
<td>4</td>
<td>78%</td>
</tr>
<tr>
<td>2</td>
<td>Principal Components Analysis</td>
<td>Varimax</td>
<td>4</td>
<td>78%</td>
</tr>
</tbody>
</table>

Although the rotated and non-rotated solutions yield similar results, rotation makes the factors as distinctive as possible (Kachigan, 1991; Pedhazur & Schmelkin, 1991; Gorsuch, 1983; Cattell, 1978). Therefore, the Varimax-rotation is preferable to the un-rotated solution. Ultimately, the Principal components analysis with the Varimax-rotation was selected for a more focused analysis. Figure 10 shows the scree plot of eigenvalues for the Varimax rotated PCA model.
Figure 10: Scree Plot of Eigenvalues of Varimax Rotation

The scree plot above shows the percentage of total variance accounted for by each of the extracted factors. The concept of the scree plot is that factors located along the tail end of the curve represent random error variance and that we should select the factor solution just prior to the leveling of the curve. This criterion suggests a 4-factor solution for the PCA analysis, reinforcing the decision based on the eigenvalues.

Table 20 outlines the eigenvalues and percentage of variance for the Varimax-rotated solution to the PCA.
Table 20: Total variance explained

<table>
<thead>
<tr>
<th>Component</th>
<th>Varimax-Rotated Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eigenvalue</td>
</tr>
<tr>
<td>1</td>
<td>7.264</td>
</tr>
<tr>
<td>2</td>
<td>2.881</td>
</tr>
<tr>
<td>3</td>
<td>2.431</td>
</tr>
<tr>
<td>4</td>
<td>1.559</td>
</tr>
</tbody>
</table>

Similar to the beta values in regression, the factors in the principal components analysis show individual relationships. The four extracted factors are all linear combinations of the original correlated variables and are derived in decreasing order of importance. In other words, the first factor accounts for as much as possible of the variation on the original data.

The Varimax-rotated component matrix (Table 21) summarizes the factor loadings for each of the 18 original variables. The factor loading values represent the correlation coefficients between the variables and the four new factors. A lower bound of 0.06 was selected for meaningful loadings and the moderate to high factor loadings are starred in the table below. The values printed in the component matrix are multiplied by 100 and rounded to the nearest integer. None of the variables had high loadings on more than one factor.
Table 21: Varimax-Rotated Component Matrix

<table>
<thead>
<tr>
<th></th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Educational Attainment Z</td>
<td>91*</td>
<td>10</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Median Home Value Z</td>
<td>-65*</td>
<td>-57</td>
<td>-9</td>
<td>18</td>
</tr>
<tr>
<td>Race: American Indian/Alaskan Native Z</td>
<td>86*</td>
<td>7</td>
<td>2</td>
<td>-21</td>
</tr>
<tr>
<td>Race: Hispanic Z</td>
<td>91*</td>
<td>-7</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>Unemployment Z</td>
<td>65*</td>
<td>35</td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td>Female Householders Z</td>
<td>77*</td>
<td>51</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Median Household Income Z</td>
<td>-61*</td>
<td>-32</td>
<td>-58</td>
<td>18</td>
</tr>
<tr>
<td>Race: African American Z</td>
<td>4</td>
<td>91*</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Race: Native Hawaiian/Other Pac Islander Z</td>
<td>34</td>
<td>65*</td>
<td>-9</td>
<td>45</td>
</tr>
<tr>
<td>Poverty Z</td>
<td>43</td>
<td>13</td>
<td>70*</td>
<td>11</td>
</tr>
<tr>
<td>Age 14 and Younger Z</td>
<td>59</td>
<td>12</td>
<td>-73*</td>
<td>9</td>
</tr>
<tr>
<td>Renters Z</td>
<td>14</td>
<td>6</td>
<td>89*</td>
<td>12</td>
</tr>
<tr>
<td>Race: Asian Z</td>
<td>-43</td>
<td>15</td>
<td>-6</td>
<td>82*</td>
</tr>
<tr>
<td>Race: White Z</td>
<td>-17</td>
<td>-41</td>
<td>0</td>
<td>-85*</td>
</tr>
<tr>
<td>Linguistically Isolated Z</td>
<td>53</td>
<td>-17</td>
<td>27</td>
<td>66*</td>
</tr>
<tr>
<td>Population Size Z</td>
<td>13</td>
<td>51</td>
<td>37</td>
<td>30</td>
</tr>
<tr>
<td>Age 65 and Older Z</td>
<td>-53</td>
<td>-49</td>
<td>-25</td>
<td>-28</td>
</tr>
<tr>
<td>Population Living in Group Quarters Z</td>
<td>-24</td>
<td>45</td>
<td>53</td>
<td>-18</td>
</tr>
</tbody>
</table>

After running the PCA, the results of the component matrix were analyzed by studying the high-loading variables of each factor. Table 22 summarizes the results of the PCA including the descriptive names for each of the extracted factors and the highest loading variables on each. The variables listed in parenthesis load negatively.
Table 22: Summary of PCA results

<table>
<thead>
<tr>
<th>Factor names</th>
<th>High-loading variables</th>
<th>Factor loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factor 1: At-Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Positive Loadings</strong></td>
<td>Race: American Indian or Alaskan Native</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>Female Householders</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>Unemployment</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Race: Hispanic</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>Low Educational Attainment</td>
<td>91</td>
</tr>
<tr>
<td><strong>Negative Loadings</strong></td>
<td>Median home value</td>
<td>-65</td>
</tr>
<tr>
<td></td>
<td>Median household income</td>
<td>-61</td>
</tr>
<tr>
<td><strong>Factor 2: Racial Disparity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Positive Loadings</strong></td>
<td>Race: African American</td>
<td>91</td>
</tr>
</tbody>
</table>
### Table 22 (con’t.)

<table>
<thead>
<tr>
<th>Factor names</th>
<th>High-loading variables</th>
<th>Factor loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factor 3: College Towns</strong></td>
<td>Race: Native Hawaiian or Other Pacific Islander</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td><strong>Positive Loadings</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poverty</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Renter</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td><strong>Negative Loadings</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 years &amp; younger</td>
<td>-73</td>
</tr>
<tr>
<td><strong>Factor 4: Cultural Disparity</strong></td>
<td>Race: Asian</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td><strong>Positive Loadings</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Race: Asian</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Linguistically Isolated</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td><strong>Negative Loadings</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Race: White</td>
<td>-85</td>
</tr>
</tbody>
</table>

Table 23 outlines the factor loading for each of the thirty-four cities in the sample frame. The bold numbers highlight cities that load higher than the rest on one of the four extracted factors.
Table 23: Sample City Factor Loadings

<table>
<thead>
<tr>
<th>Observation</th>
<th>City</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>City of American Canyon</td>
<td>0.27603</td>
<td>1.19888</td>
<td>-1.53134</td>
<td>1.23402</td>
</tr>
<tr>
<td>2</td>
<td>City of Auburn</td>
<td>-0.22254</td>
<td>-0.45251</td>
<td>0.64465</td>
<td>-1.77974</td>
</tr>
<tr>
<td>3</td>
<td>City of Berkeley</td>
<td>-1.53506</td>
<td>1.22110</td>
<td>2.83620</td>
<td>-0.22584</td>
</tr>
<tr>
<td>4</td>
<td>City of Burlingame</td>
<td>-0.75766</td>
<td>-0.70351</td>
<td>0.49449</td>
<td>0.61750</td>
</tr>
<tr>
<td>5</td>
<td>City of Campbell</td>
<td>-0.20891</td>
<td>-0.35714</td>
<td>0.51209</td>
<td>0.25630</td>
</tr>
<tr>
<td>6</td>
<td>City of Citrus Heights</td>
<td>0.44362</td>
<td>0.49049</td>
<td>0.42717</td>
<td>-1.00868</td>
</tr>
<tr>
<td>7</td>
<td>City of Concord</td>
<td>0.64010</td>
<td>-0.35267</td>
<td>0.55367</td>
<td>1.05090</td>
</tr>
<tr>
<td>8</td>
<td>City of Davis</td>
<td>-0.57040</td>
<td>-0.34678</td>
<td>2.45301</td>
<td>0.34485</td>
</tr>
<tr>
<td>9</td>
<td>City of Elk Grove</td>
<td>-0.16745</td>
<td>2.40299</td>
<td>-1.30852</td>
<td>0.90709</td>
</tr>
<tr>
<td>10</td>
<td>City of Fairfield</td>
<td>0.21676</td>
<td>2.29741</td>
<td>-0.40921</td>
<td>0.61003</td>
</tr>
<tr>
<td>11</td>
<td>City of Folsom</td>
<td>-0.82549</td>
<td>1.29715</td>
<td>-0.02715</td>
<td>-1.07186</td>
</tr>
<tr>
<td>12</td>
<td>City of Galt</td>
<td>1.72096</td>
<td>-0.17746</td>
<td>-0.75576</td>
<td>-0.45595</td>
</tr>
<tr>
<td>13</td>
<td>City of Gilroy</td>
<td>2.24544</td>
<td>-1.09159</td>
<td>0.08676</td>
<td>0.54012</td>
</tr>
<tr>
<td>14</td>
<td>City of Half Moon Bay</td>
<td>0.42244</td>
<td>-1.57043</td>
<td>-0.02673</td>
<td>0.08279</td>
</tr>
<tr>
<td>15</td>
<td>Town of Hillsborough</td>
<td>-1.56887</td>
<td>-0.84337</td>
<td>-2.02645</td>
<td>0.88454</td>
</tr>
<tr>
<td>16</td>
<td>City of Larkspur</td>
<td>-1.14901</td>
<td>-1.11867</td>
<td>0.72595</td>
<td>-0.82351</td>
</tr>
<tr>
<td>17</td>
<td>City of Lincoln</td>
<td>-0.12806</td>
<td>-0.36875</td>
<td>-0.76089</td>
<td>-1.08133</td>
</tr>
<tr>
<td>18</td>
<td>City of Mill Valley</td>
<td>-1.06315</td>
<td>-0.73064</td>
<td>-0.45353</td>
<td>-0.97551</td>
</tr>
<tr>
<td>19</td>
<td>City of Morgan Hill</td>
<td>0.54117</td>
<td>-0.33695</td>
<td>-0.74469</td>
<td>-0.06298</td>
</tr>
<tr>
<td>20</td>
<td>City of Napa</td>
<td>0.94675</td>
<td>-0.97017</td>
<td>0.56656</td>
<td>-0.23076</td>
</tr>
<tr>
<td>21</td>
<td>City of Orinda</td>
<td>-1.53595</td>
<td>-0.80740</td>
<td>-1.52873</td>
<td>-0.46669</td>
</tr>
<tr>
<td>22</td>
<td>City of Rancho Cordova</td>
<td>0.93043</td>
<td>1.25344</td>
<td>0.28010</td>
<td>0.32015</td>
</tr>
<tr>
<td>23</td>
<td>City of Redwood City</td>
<td>0.45654</td>
<td>-0.36345</td>
<td>0.44238</td>
<td>0.91409</td>
</tr>
<tr>
<td>24</td>
<td>City of Rocklin</td>
<td>-0.18676</td>
<td>0.41185</td>
<td>-0.58793</td>
<td>-1.16222</td>
</tr>
<tr>
<td>25</td>
<td>City of Roseville</td>
<td>-0.14951</td>
<td>0.42467</td>
<td>-0.28253</td>
<td>-0.87358</td>
</tr>
</tbody>
</table>
What the factor analysis has uncovered are four independent community characteristic dimensions that underlie the eighteen individual input variables. These new, uncorrelated dimensions describe four community factors that are the best representation of the larger set of community characteristic data.

When interpreting the results of a principal components analysis, it can be revealing to interpret the opposite loadings on variables, largely because factor loadings represent the degree to which the variable correlates with the factor (Kachigan, 1991). Researchers can gain additional insight into their data by reading negative factor loading results as having a positive loading and a positive result as having a negative loading. For example, when the variables are re-evaluated as negative factors, communities that have high negative loading on Factor 1, or “At-Risk,” are those that have high median
household income and high median home values and are relatively low-risk communities. Evaluating negative factor loadings provides alternative ways of looking at the data that offers additional insight into the contexts of the planning processes within the sample communities.

Based on the results of the PCA, the variables with high factor loadings on Factor 1, At-Risk, are as follows: Race: American Indian or Alaskan Native; Female Householders; Unemployment; Race: Hispanic; Low Educational Attainment; Median Home Value (negative); and Median Household Income (negative). The City of Gilroy loads high on this factor and is an example of an at-risk community.

In Factor 1 the variables for median home value and median household income both load negatively. A reinterpretation of the negative factor loadings on this factor describes affluent communities characterized by high educational attainment, low unemployment levels and lower populations of Hispanic minorities and female householders. The City of Saratoga loads negatively on Factor 1.

Race can contribute to social vulnerability to hazards through limited access to resources, cultural differences and the social, economic, and political marginalization that is often associated with racial disparities (Cutter et al. 2003). The Cities of Elk Grove and Fairfield are examples of communities that load high on Factor 2, Racial Disparity. The variables loading high on this factor are Race: African American and Race: Native Hawaiian/Other Pacific Islander. Based on Cutter’s (2003) work on social vulnerability to hazards, Race: African American is the racial variable that corresponds to the highest level of vulnerability to hazards. Cutter (2003) finds that African Americans are more likely to live in at-risk housing or in multi-unit structures, relative to other racial groups.
As was explored in Chapter 2, minority communities are often excluded from disaster planning and preparation activity. As a result, planning activities often move forward without consideration of minority culture and life circumstances (Morrow, 1999). Factor 2 was given the name “Racial Disparity” to reflect the effect of high levels of African Americans on local social vulnerability to disasters. The City of Half Moon Bay loads negatively on Factor 2 and is representative of a city characterized by low levels of Racial Disparity related to hazard vulnerability.

The variables loading high on Factor 3, College Towns, describe communities characterized with large residential universities or colleges. The City of Davis and the City of Berkeley load highly on Factor 3 and are home to two large university campuses (the University of California, Berkeley and the University of California Davis, respectively). The negative loading of 14 years and younger on Factor 3 is intuitive, as the majority of college-age students in have not yet had children. The Town of Hillsborough loads negatively on Factor 3.

Communities like Davis and Berkeley are places where a large percentage of the residential population is made up of students. Typically, these students rent dorm rooms or temporary housing, work on campus or in the local community, and earn small salaries. Often, the economies of college towns are closely related to university activity and in many cases the university is one of the largest employers in the community.

Housing quality is an important factor to consider when evaluating local vulnerability to hazards. (Morrow, 1999; De Souza, 2006). Typically, housing quality is closely tied to personal wealth. Generally, people with lower incomes tend to live in poorly constructed homes, in multifamily housing in densely populated urban areas, or in
mobile homes. Each of these housing types has elevated vulnerability to storms, fire, earthquakes and other hazards. For example, previous studies on the impacts of tornadoes in the Carolinas (Eidson et al. 1990) and Oklahoma (Daley et al. 2005) have associated increased structural damage and injuries to people who live in mobile homes and older housing stock. Additionally, in the context of the 1995 Northridge, California earthquake, Peek-Asa et al. (2003) found that people living in multiple-unit housing structures are more likely to sustain injuries than those living in single-family homes.

The variables loading high on Factor 4, Cultural Disparity, are as follows: Race: Asian; Linguistically Isolated; Race: White (negative). Studies carried out by the Centers for Disease Control and Prevention and the Agency for Toxic Substances and Disease Registry (CDC/ATSDR, 2008) have found that the presence of Asian populations correlates positively with hazard vulnerability. They attribute these results from the fact that some hazard-prone coastal cities, particularly those of the western United States, have higher percentages of inhabitants of Asian descent. Moreover, their study found that more recent arrivals from Asia tend to live in substandard housing stock (CDC/ATSDR, 2008). Additionally, in areas where there are significant populations of partially or fully non-English speaking populations, communication barriers contribute significantly to elevated hazard vulnerability (Morrow, 1999).

The cities of Sunnyvale and Santa Clara (which both load high on Factor 4) are two of the top-ten US metropolitan areas with the highest population of Asian
Americans\textsuperscript{6}. These communities are characterized by high levels of Cultural Disparity associated with lower relative populations of White residents and high levels of Asians and linguistically isolated individuals. The City of Auburn, a negatively loading city on Factor 4, is characterized by a low Asian population, high percentages of White residents, and little to no residents who identify as limited English speakers.

In the following section, the four extracted factors – At-Risk, Racial Disparity, College Towns, and Cultural Disparity – are used in a multiple regression analysis to uncover relationships between community characteristics, plan quality and participation within the study region. The highly loading sample cities (both positive and negative) are used as contextual tools for interpreting the statistical results.

Multiple Regression Analysis

Regression analysis is a useful method for estimating relationships among sets of variables. For the purpose of this study, the multiple regression technique is applied for the purpose of uncovering relationships between community characteristics, public participation in planning and hazard mitigation plan quality.

Rather than using values of one predictor variable to estimate values on a criterion variable, multiple regression uses values on several predictor variables. The regression analysis in this study follows a General Linear Model (GLM) approach, which uses to

\textsuperscript{6} US Census Bureau.
method of least squares to fit general linear models. This approach was selected because of its generality but also for its flexibility.

The following statistical analyses were performed using SAS software. To begin, the univariate procedure was applied to test the Plan Quality data for normality. The four tables below summarize the results of the SAS normality test.

<table>
<thead>
<tr>
<th>Table 24: Moments</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std Deviation</td>
</tr>
<tr>
<td>Skewness</td>
</tr>
<tr>
<td>Uncorrected SS</td>
</tr>
<tr>
<td>Coeff Variation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 25: Basic Statistical Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Mode</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Table 26: Tests for Location: Mu0 = 0

<table>
<thead>
<tr>
<th>Test</th>
<th>Statistic</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student's t</td>
<td>t</td>
<td>16.04485</td>
</tr>
<tr>
<td>Sign</td>
<td>M</td>
<td>17</td>
</tr>
<tr>
<td>Signed Rank</td>
<td>S</td>
<td>297.5</td>
</tr>
</tbody>
</table>

Table 27: Tests for Normality

<table>
<thead>
<tr>
<th>Test</th>
<th>Statistic</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shapiro-Wilk</td>
<td>W</td>
<td>0.959127</td>
</tr>
<tr>
<td>Kolmogorov-Smirnov</td>
<td>D</td>
<td>0.099013</td>
</tr>
<tr>
<td>Cramer-von Mises</td>
<td>W-Sq</td>
<td>0.069021</td>
</tr>
<tr>
<td>Anderson-Darling</td>
<td>A-Sq</td>
<td>0.511194</td>
</tr>
</tbody>
</table>

Because the mean and median are relatively close to one another we assume that the data is normalized. In addition, the normal probability plot below (Figure 11) shows normality with the smooth 45 degree slope.
The central limit theorem states that when the number of observations is over $N = 31$ you can use the theorem to assume normality. Therefore, even though the sample size of $N = 34$ is small, we can still assume normality with this graph.

The table below (Table 28) outlines the progression of the regression models completed for this study and the dependent and independent variables applied to each model.

---

Table 28: Summary of Regression Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Dependent Variable</th>
<th>Independent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Plan Quality</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 2</td>
<td>Fact Base Score</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 3</td>
<td>Actions score</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 4</td>
<td>Goals score</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 5</td>
<td>Participation</td>
<td>Factors 1 - 4</td>
</tr>
<tr>
<td>Model 6</td>
<td>Plan Quality</td>
<td>Participation</td>
</tr>
<tr>
<td>Model 7</td>
<td>Fact Base</td>
<td>Participation</td>
</tr>
<tr>
<td>Model 8</td>
<td>Actions score</td>
<td>Participation</td>
</tr>
<tr>
<td>Model 9</td>
<td>Goals score</td>
<td>Participation</td>
</tr>
<tr>
<td>Model 10</td>
<td>Plan Quality</td>
<td>Planning Scale</td>
</tr>
</tbody>
</table>

The ten regression models outlined above have been designed to address the three aims associated with research question number two. Together, the models accomplish the following aims:

1. To identify key relationships between local community characteristics and local plan quality;
2. To analyze how community characteristics affect public participation during local hazard mitigation planning; and
3. To evaluate how public participation during planning affects local hazard mitigation plan quality
Models 1 – 4 address Research Aim 1: To identify key relationships between local community characteristics and local plan quality scores. Additionally, Models 1 – 4 take a General Linear Model approach (or GLM) to regression analysis. The GLM procedure uses a method of least squares to fit general linear models. It is a flexible method that allows researchers to test hypotheses suited for regression, ANOVA (analysis of variance), ANCOVA (analysis of covariance) and a number of additional analyses. Additionally, the Type III Sum of Squares option (Type III SS) tests the unique contribution of each independent variable included in the analysis.

Model 1 uses Plan Quality Score as the dependent variable and Factors 1 – 4 as the independent variables. When interpreting the results of each regression model, 0.05 was used as the threshold for the P value. Based on this parameter, independent variables with P values < 0.05 are deemed significant. The SAS output results for Model 1 are presented below.

Table 29: Model 1 (Plan Quality Score)

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>0.34643674</td>
<td>0.34643674</td>
<td>0.05</td>
<td>0.8211</td>
</tr>
<tr>
<td>Factor 2</td>
<td>1</td>
<td>0.82008517</td>
<td>0.82008517</td>
<td>0.12</td>
<td>0.7280</td>
</tr>
<tr>
<td>Factor 3</td>
<td>1</td>
<td>4.70816110</td>
<td>4.70816110</td>
<td>0.71</td>
<td>0.4070</td>
</tr>
<tr>
<td>Factor 4</td>
<td>1</td>
<td>12.35077761</td>
<td>12.35077761</td>
<td>1.86</td>
<td>0.1835</td>
</tr>
</tbody>
</table>

Based on the regression model there is no relationship between Factors 1 – 4 and local hazard mitigation Plan Quality Scores. As expected, because a number of the
community characteristic variables included in the PCA were accounted for in the plan quality scoring criteria, we see no residual effects of the variables on Plan Quality Score. In other words, the community characteristic variables are located on both sides of this regression model so we see no associations in Model 1.

To more closely assess key relationships between local community characteristics and Plan Quality, the following three models (Model 2 – 4) apply the three individual components of Plan Quality as dependent variables and Factors 1 – 4 as independent variables.

In Model 2, the dependent variable is Fact Base Scores and Factors 1 – 4 are the independents. The SAS output for Model 2 is presented below. The results indicate that community characteristics do not affect Fact Base Score outcomes.

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>0.19414049</td>
<td>0.19414049</td>
<td>0.28</td>
<td>0.6039</td>
</tr>
<tr>
<td>Factor 2</td>
<td>1</td>
<td>0.21081148</td>
<td>0.21081148</td>
<td>0.30</td>
<td>0.5889</td>
</tr>
<tr>
<td>Factor 3</td>
<td>1</td>
<td>0.88836123</td>
<td>0.88836123</td>
<td>1.26</td>
<td>0.2712</td>
</tr>
<tr>
<td>Factor 4</td>
<td>1</td>
<td>0.00681187</td>
<td>0.00681187</td>
<td>0.01</td>
<td>0.9224</td>
</tr>
</tbody>
</table>

In Model 3, Actions Score is the dependent variable and Factors 1 – 4 are the independents. The output for Model 3 is presented below. The results of the model
indicate that Factors 1 – 4 do not affect the Actions Score outcomes of local hazard mitigation plans in the study area.

Table 31: Model 3 (Actions Score)

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>2.52350213</td>
<td>2.52350213</td>
<td>2.96</td>
<td>0.0965</td>
</tr>
<tr>
<td>Factor 2</td>
<td>1</td>
<td>0.15686868</td>
<td>0.15686868</td>
<td>0.18</td>
<td>0.6713</td>
</tr>
<tr>
<td>Factor 3</td>
<td>1</td>
<td>1.01359851</td>
<td>1.01359851</td>
<td>1.19</td>
<td>0.2850</td>
</tr>
<tr>
<td>Factor 4</td>
<td>1</td>
<td>0.56041457</td>
<td>0.56041457</td>
<td>0.66</td>
<td>0.4245</td>
</tr>
</tbody>
</table>

In Model 4, Goals Score is the dependent variable and Factors 1 – 4 are the independents. The SAS output for Model 4 is shown below. Again, the results of the model indicate that Factors 1 – 4 do not affect the Goals Score outcomes of local hazard mitigation plans in the study area. The results of Model 4 are intuitive because mitigation planning goals are set and standardized by FEMA.

Table 32: Model 4 (Goals Score)

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>0.83052862</td>
<td>0.83052862</td>
<td>0.31</td>
<td>0.5819</td>
</tr>
<tr>
<td>Factor 2</td>
<td>1</td>
<td>0.70435459</td>
<td>0.70435459</td>
<td>0.26</td>
<td>0.6120</td>
</tr>
<tr>
<td>Factor 3</td>
<td>1</td>
<td>0.38316457</td>
<td>0.38316457</td>
<td>0.14</td>
<td>0.7080</td>
</tr>
<tr>
<td>Factor 4</td>
<td>1</td>
<td>3.85563711</td>
<td>3.85563711</td>
<td>1.44</td>
<td>0.2401</td>
</tr>
</tbody>
</table>
This study addresses Research Aim 2 – *To analyze how community characteristics affect levels of public participation in local hazard mitigation planning* – by building a regression model with Participation Score as the dependent variable and Factors 1 – 4 as the independents. The logistic approach was selected for Model 5 because the participation data is expressed as a set of binary variables. The logistic procedure fits linear regression models for binary data by using the maximum likelihood method. The maximum likelihood estimation was carried out using the Fisher-scoring algorithm.

Below, the Analysis of Maximum Likelihood Estimates table lists the calculated parameter estimates of Model 5, their standard errors and the results of the Wald test for individual parameters.

**Table 33: Model 5. Analysis of Maximum Likelihood Estimates (Participation Score)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>DF</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>Wald Chi-Square</th>
<th>Pr &gt; ChiSq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>-3.7943</td>
<td>1.6316</td>
<td>5.4083</td>
<td>0.0200</td>
</tr>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>2.1177</td>
<td>1.2223</td>
<td>3.0017</td>
<td>0.0832</td>
</tr>
<tr>
<td>Factor 2</td>
<td>1</td>
<td>1.9060</td>
<td>0.9291</td>
<td>4.2081</td>
<td><strong>0.0402</strong></td>
</tr>
<tr>
<td>Factor 3</td>
<td>1</td>
<td>-1.4841</td>
<td>1.1054</td>
<td>1.8023</td>
<td>0.1794</td>
</tr>
<tr>
<td>Factor 4</td>
<td>1</td>
<td>-2.3781</td>
<td>1.2288</td>
<td>3.7456</td>
<td>0.0529</td>
</tr>
</tbody>
</table>

The SAS output results identify Factor 2 as a significant predictor of participation score. If we recall, Factor 2 represents a racial dimension of local community
characteristics. Race: African American and Race: Native Hawaiian and Other Pacific Islander have high factor loadings on Factor 2.

Models 6 – 9 address Research Aim 3: To evaluate how public participation in planning affects local hazard mitigation plan quality. In Model 6, Plan Quality is the dependent variable and Participation Score the independent. The table below summarizes the results of the model.

Table 34: Model 6 (Plan Quality Score)

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation Score</td>
<td>1</td>
<td>6.05084235</td>
<td>6.05084235</td>
<td>0.94</td>
<td>0.3385</td>
</tr>
</tbody>
</table>

The results indicate that there is no association between Plan Quality Scores and Participation Scores recorded from the local hazard mitigation planning process.

The dependent variable in Model 7 is Fact Base Score. Factors 1 – 4 and Participation are the independents. The results summarized in the table below indicate that neither Participation Score nor Factors 1 – 4 affect the Fact Base Scores of local hazard mitigation plans in the study area.
Table 35: Model 7 (Fact Base Score)

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>0.19414049</td>
<td>0.19414049</td>
<td>0.28</td>
<td>0.6039</td>
</tr>
<tr>
<td>Factor 2</td>
<td>1</td>
<td>0.21081148</td>
<td>0.21081148</td>
<td>0.30</td>
<td>0.5889</td>
</tr>
<tr>
<td>Factor 3</td>
<td>1</td>
<td>0.88836123</td>
<td>0.88836123</td>
<td>1.26</td>
<td>0.2712</td>
</tr>
<tr>
<td>Factor 4</td>
<td>1</td>
<td>0.00681187</td>
<td>0.00681187</td>
<td>0.01</td>
<td>0.9224</td>
</tr>
<tr>
<td>Participation Score</td>
<td>1</td>
<td>2.57949103</td>
<td>2.57949103</td>
<td>3.66</td>
<td>0.0661</td>
</tr>
</tbody>
</table>

The dependent variable in Model 8 is Action Score. Factors 1 – 4 and Participation are the independents. Below, the summarized results indicate that neither Participation Scores nor Factors 1 – 4 affect the Actions Scores of local hazard mitigation plans in the study area.
Table 36: Model 8 (Actions Score)

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>2.52350213</td>
<td>2.52350213</td>
<td>2.96</td>
<td>0.0965</td>
</tr>
<tr>
<td>Factor 2</td>
<td>1</td>
<td>0.15686868</td>
<td>0.15686868</td>
<td>0.18</td>
<td>0.6713</td>
</tr>
<tr>
<td>Factor 3</td>
<td>1</td>
<td>1.01359851</td>
<td>1.01359851</td>
<td>1.19</td>
<td>0.2850</td>
</tr>
<tr>
<td>Factor 4</td>
<td>1</td>
<td>0.56041457</td>
<td>0.56041457</td>
<td>0.66</td>
<td>0.4245</td>
</tr>
<tr>
<td>Participation Score</td>
<td>1</td>
<td>0.30273340</td>
<td>0.30273340</td>
<td>0.35</td>
<td>0.5562</td>
</tr>
</tbody>
</table>

Goals Score is the dependent variable in Model 9. Factors 1 – 4 and Participation Score are the independents. The SAS output of Model 9 is presented below and indicates that neither Participation Scores nor Factors 1 – 4 affect the Goals Scores of local hazard mitigation plans in the study area.

Table 37: Model 9 (Goals Score)

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>0.83052862</td>
<td>0.83052862</td>
<td>0.31</td>
<td>0.5819</td>
</tr>
<tr>
<td>Factor 2</td>
<td>1</td>
<td>0.70435459</td>
<td>0.70435459</td>
<td>0.26</td>
<td>0.6120</td>
</tr>
<tr>
<td>Factor 3</td>
<td>1</td>
<td>0.38316457</td>
<td>0.38316457</td>
<td>0.14</td>
<td>0.7080</td>
</tr>
<tr>
<td>Factor 4</td>
<td>1</td>
<td>3.85563711</td>
<td>3.85563711</td>
<td>1.44</td>
<td>0.2401</td>
</tr>
<tr>
<td>Participation Score</td>
<td>1</td>
<td>0.00115569</td>
<td>0.00115569</td>
<td>0.00</td>
<td>0.9836</td>
</tr>
</tbody>
</table>
During the Plan Quality evaluation phase of this study, patterns began to emerge in the data related to plan quality and the scale at which local plans were created. Under DMA 2000, local communities have the choice to create single-jurisdiction or multi-jurisdiction hazard mitigation plans for FEMA review. Over the course of the statistical analysis, planning scale began to emerge as a potential driver of Plan Quality results. Model 10 explores this relationship. Here, Plan Quality is the dependent variable and Planning Scale and Factors 1 – 4 are included as independents. The table below summarizes the results of Model 10.

Table 38: Model 10 (Plan Quality Score)

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan Scale</td>
<td>1</td>
<td>74.75372534</td>
<td>74.75372534</td>
<td>17.72</td>
<td>0.0002</td>
</tr>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>1.53647702</td>
<td>1.53647702</td>
<td>0.36</td>
<td>0.5511</td>
</tr>
<tr>
<td>Factor 2</td>
<td>1</td>
<td>4.13020590</td>
<td>4.13020590</td>
<td>0.98</td>
<td>0.3309</td>
</tr>
<tr>
<td>Factor 3</td>
<td>1</td>
<td>0.42354710</td>
<td>0.42354710</td>
<td>0.10</td>
<td>0.7537</td>
</tr>
<tr>
<td>Factor 4</td>
<td>1</td>
<td>3.35684349</td>
<td>3.35684349</td>
<td>0.80</td>
<td>0.3800</td>
</tr>
</tbody>
</table>

The results of the model show that within the sample frame, Planning Scale is driving Plan Quality. Moreover, Planning Scale, independent of community characteristics (Factors 1 – 4), predicts improved Plan Quality Scores by quite a large amount (P = .0002).

Looking at the relationship between Planning Scale and Plan Quality Scores more closely, the regression model below applies Fact Base Score as the dependent variable
and Planning Scale as the independent. Below, Table 39 summarizes the SAS output results.

Table 39: Does Planning Scale Affect Fact Base Scores?

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Type III SS</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan Scale</td>
<td>1</td>
<td>9.54602943</td>
<td>9.54602943</td>
<td>22.63</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

The results confirm the hypothesis that Planning Scale strongly affects the Fact Base Scores of local hazard mitigation plans. This finding prompts the following question: What approach to planning – a single or multi-jurisdictional effort – is associated with higher Fact Base scores? The multiple regression analysis below explores this question (Table 40).

Table 40: Fact Base (the GLM Procedure; Least Square Means)

<table>
<thead>
<tr>
<th>Planning Scale</th>
<th>Fact Base Score LSMEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Jurisdiction Plans</td>
<td>0.95639286</td>
</tr>
<tr>
<td>Single Jurisdiction Plans</td>
<td>2.34633333</td>
</tr>
</tbody>
</table>

The results indicate that within the study area, single-jurisdiction local hazard mitigation plans are associated with higher Fact Base score outcomes. This finding is significant because of the large amount of focus and attention given to fostering multi-jurisdictional coordination during hazard mitigation planning.
Results and Discussion

This chapter assessed variations in Plan Quality scores across a sample of 34 local hazard mitigation plans. In addition, it consists of a principal components analysis designed to identify underlying factors in the local community characteristic data.

By achieving the following three aims, the regression models addressed the overarching research question of how community characteristics and levels of public participation affect local mitigation plan quality outcomes:

- Aim 1: To identify key relationships between local community characteristics and local plan quality scores;
- Aim 2: To analyze how community characteristics affect levels of public participation in local hazard mitigation planning; and
- Aim 3: To evaluate how public participation in planning affects local hazard mitigation plan quality.

The results of the quantitative analysis indicate that within the study area public participation is not associated with recent local mitigation plan quality outcomes. Additionally, Models 1 – 4 demonstrate no associations between community characteristics and local Plan Quality scores. For example, At-Risk communities do not have significantly higher or lower quality plans than affluent communities, nor do communities with high levels of Cultural Disparity have lower quality hazard mitigation plans than predominantly White, English-speaking communities.

The finding that plan quality does not differ between communities based on social vulnerability is significant. Although plan quality is not consistently high in socially
vulnerable communities, the fact that plan quality is not worse suggests that despite limited resources and socioeconomic hardship the most vulnerable communities in the study region have not been systematically underserved. Although the results do not suggest systematic planning failures in the region, communities within the sample area appear to have paid very little attention to the social vulnerability profiles of their planning jurisdictions when developing their local hazard mitigation plans. This is problematic from the disaster resilience perspective. Although social vulnerability is complex and often eclipsed by the risks posed by physical hazards, it is one of the largest threats to local disaster resiliency.

As previously discussed, the Fact Base component of Plan Quality consists of a range of indicators related to the physical location and extent of hazard damage, including the magnitude of hazard events, exposed populations, and evacuation clearance times. It also includes indicators related to local demographics, education levels, health services, social services and the economy, all of which are commonly used indicators of local social vulnerability. Across the sample of 34 plans included in this study, Fact Base Scores are consistently low. Contextual understandings about social vulnerability and applications of local information have been largely absent from the process of local hazard mitigation planning across the study region. Planning agencies must learn to understand social vulnerability, and the root causes specific to their communities, in order to build resiliency through planning. Ultimately, this approach demands that social vulnerability reduction play a larger role in driving decision making related to mitigation actions and goal setting.
Out of the four extracted factors from the principal components analysis, Factor 2, Racial Disparity, was the only factor that had a relationship to the Participation variable. Factor 2 emerged as a significant predictor of participation levels during planning and describes communities in which the dominant minority (in this case African Americans and Native Hawaiian/Other Pacific Islanders) is at the table. The cities of Fairfield and Elk Grove both have high loadings on Factor 2. Although it is not within the scope of this study to identify why certain stakeholders participate in the hazard mitigation planning process, future studies might explore the factors that explain increased participation in communities characterized by high levels of Racial Disparity in the context of hazard vulnerability.

In addition to addressing Aims 1 and 2, the results of the quantitative analysis show that participation does not influence plan quality as previously thought. High levels of public participation in planning do not drive plan quality outcomes, nor do they affect the Fact Base Scores of local plans in the study area. This finding leads to the conclusion that “plan quality” may not be the most appropriate metric for “good” planning. In addition to the results of this study, there is very little empirical proof that high quality hazard mitigation plans lead to better results in terms of risk, vulnerability, and loss reduction outcomes.

Despite the results that show no association between participation and plan quality outcomes, the literature maintains that participatory planning can result in valuable learning opportunities and risk reduction outcomes for those involved. Meaningful participation is often a positive end in itself, even if it does not result in empirically better plans. While public participation seems to have little to no benefits when plan quality is
the measured outcome, participation may have powerful implications for the success of
plan implementation over the long run. Moreover, it is very unlikely that these beneficial
outcomes are measurable through existing plan quality metrics. These discussions
highlight important directions for future research studies to explore.

A final key finding from this phase of the study is that Planning Scale drives plan
quality outcomes to a greater degree than any of the other variables addressed in this
study. Specifically, the single-jurisdiction approach to local hazard mitigation planning is
associated with higher Fact Base scores. These findings suggest that single-jurisdiction
plans have been more successful at incorporating locally-relevant information about
social vulnerability and community capacity into plans than those created at the multi-
jurisdiction scale. In addition to cost reduction, one of the justifications of the multi-
jurisdictional approach to planning is that it enables communities to simultaneously plan
for regional climate change impacts and local hazards. Additionally, multi-jurisdictional
efforts allow communities to pool their resources and establish partnerships related to
each of the four phases of the emergency management cycle.

The results from this analytical phase open the door to deeper, more focused
evaluations of local hazard mitigation planning processes and social vulnerability
assessment. Future research may further explore the relationship between plan Fact Base
Scores and social vulnerability outcomes by evaluating local reductions in social
vulnerability over time in cities with a wide range of participation scores.

Through a series of in-depth stakeholder interviews and archival document analysis,
the following chapter offers insight into the planning environments in which high and
low quality local hazard mitigation plans are created. The interviews enable deep,
focused investigation into local planning processes of interest and aim to explain the results of the statistical analysis. The detailed investigation of specific jurisdictions’ participatory planning methodologies reveals rich information about the planning participation processes, including how local social vulnerability information has been used in decision making (information that is nearly impossible to glean from document analysis alone). Additionally, the following case study analysis is designed to shed light on why single-jurisdictional plans out-perform multi-jurisdictional plans in the region.
CHAPTER V
A QUALITATIVE EVALUATION OF LOCAL MITIGATION PLANNING

Introduction

In testing ideas about how public participation should play a role local hazard mitigation planning, we need to assess what the role of public participation currently is. Hardly ever is planning a cut and dry process. It is heavily influenced by politics, social dynamics, economics, physical geography and myriad other factors that define the place and character of any community. The six case studies in this chapter focus on places of varying size and circumstance. Each case is an attempt to learn what factors have driven the successes and shortcomings experienced by those communities in the context of local hazard mitigation planning.

This chapter consists of a series of instrumental case studies that help provide insight into the results of the previous quantitative analysis. Through a series of in-depth stakeholder interviews and archival document analysis, we investigate the participatory planning methods of diverse communities within the study area. In addition to examining the successes and failures of both single and multi-jurisdictional planning efforts, the in-depth interviews help to identify additional outcomes associated with high levels of public participation during local hazard mitigation planning. Ultimately, the goal of this chapter is to better understand the planning contexts in which the highest and lowest quality plans are produced. In addition, this phase of the study will explore the factors that contribute to successful hazard mitigation planning, regardless of planning scale.
Methods

This section discusses the data collection tools used for the interview phase of this study including interview guides, reflexive journal and coding procedures. It also describes how decisions about case selection were made.

Interview Guides

A semi-structured interview approach was used for this portion of the study. In lieu of using a sequence of identical, scripted questions for every interview, the semi-structured approach allows interviews to be conducted with more flexibility. By using an interview guide, we ensure that the same general areas of information are collected from each interviewee while simultaneously allowing for a degree of adaptability during each conversation.

Two interview guides were created, one for conversations with organizational participants and another for conversations with local community participants. It was necessary to develop two interview guides because in most cases the organizational and community stakeholders had starkly different roles, responsibilities, and access to information during the planning process. Therefore, different questions and topics were relevant to participants from each stakeholder type.

The interview guides were designed to assess each participant’s experience with public participation in the context of local hazard mitigation planning. In each of the interview guides, discussion questions were designed to address the goals, successes and challenges related to the public participation strategies employed in the stakeholder’s city
as well as details about public participation in their jurisdiction during local hazard mitigation planning and the overall planning environment.

Data Collection and Storage

Each interviewee was first contacted through email and asked to participate in the interview process. Follow-up emails were sent to non-respondents seven days after the initial interview request. In accordance with COMIRB Human Subjects policy, potential interviewees were not contacted more than three times to schedule an interview.

After receiving participant consent, the interviews were conducted using Skype to allow for audio recording during each conversation. Although interviewees were given a guarantee of confidentiality, some interviewees declined to have their conversations recorded. In these cases, participant responses were recorded by hand for the purpose of transcription and analysis.

Each interview was designed to last thirty minutes. Once an interview was completed, the conversation was transcribed and the text uploaded into NVivo 9, a qualitative data analysis software that enables researchers to code qualitative data and conduct systematic analysis to find patterns, relationships, and themes.

A codebook was developed as a tool for analyzing the interview data. It assisted in dissecting the interview data in meaningful ways while keeping the relationships between parts intact (Miles & Huberman, 1994). The codebook was made up of a set of descriptive codes that attribute types of phenomena to segments of text. Initially, the codebook was developed at the same time as the interview guides. However, as the field
experience developed over time, the codes were revised and changed. New codes were added and others were broken down into sub-codes.

After the interviews were coded, case summary outlines were created for each city. The purpose of the case summary outlines was to present a summary of preliminary findings, to provide a review of data quality, and to outline an agenda for the next stage of analysis. The case summary outlines proved to be incredibly useful during data analysis because they provided the first coherent, broad portrait of each case.

Reflexive Journal

In addition to collecting detailed responses from interviewees, focused time was spent journaling directly after each interview. The reflexive journal included information about initial impressions of the interview including reactions to answers and questions that arose. Ultimately, the reflexive journal contributed to the reliability of the study as well as its internal and external validity. It provided an additional method for organizing data and emerging ideas and made it possible to return to the interview data again and again over time.

Case Selection

Two key propositions guide the selection of the case studies presented in this chapter. First, although various factors influence the hazard mitigation plan quality, communities within the sample frame who take single-jurisdiction approaches to mitigation planning produce higher quality plans than those who take multi-jurisdictional approaches. Second, although the quantitative phase of this study provided no empirical evidence that participation contributes to higher quality mitigation plans, the literature
maintains that participatory planning leads to improved planning outcomes over time. These propositions guide the qualitative phase of this study and provide limits to the scope of the case study analyses.

A stratified purposeful sampling approach was used to select case study communities. The approach allows for the selection of particular cases for analysis that vary according to key dimensions and was selected to ensure the representation of communities with varied participation and quality outcomes. It involves the identification of samples within samples by highlighting characteristics of particular subgroups of interest. Ultimately, by facilitating comparisons between subgroups of interest, this sampling approach allows researchers to capture major variations in a phenomenon between cases (Miles & Huberman, 1994). Because this phase of analysis is interested in exploring why Planning Scale drives Fact Base scores and how participation may contribute to improved hazard mitigation planning outcomes other than Plan Quality, the case studies have been selected based on participation levels and Fact Base scores.

Fact Base was selected as a dimension of interest over Plan Quality in an attempt to isolate the effects of community context and participatory planning activity on the collection and incorporation of information about social vulnerability into planning. By comparing the experiences of communities that have been successful at incorporating information about local social vulnerability with those that have not, we are better able to identify the factors that contribute to the creation of detailed, locally relevant mitigation plans.

The Participation and Fact Base data recorded during the plan quality analysis were used to guide the selection of the case studies. Initially, the thirty-four cities in the
sample were organized into the subgroups by calculating the mean Fact Base score for the sample. Out of a total possible score of 10 points, the mean Fact Base score of all of the local plans was 1.202 points. The population standard deviation was then calculated for the sample and yielded a value of 0.836. The plans with high and low Fact Base scores were selected by sampling all of the plans with Fact Base scores of one standard deviation above the mean and one standard deviation below the mean. This sampling approach yielded a sample of six case study cities (Table 41).

Table 41: Case Study Sampling Based on Fact Base Scores

<table>
<thead>
<tr>
<th>City</th>
<th><strong>High Fact Base Score</strong> (1 standard deviation above the mean)</th>
<th><strong>Low Fact Base Score</strong> (1 standard deviation below the mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Roseville (M3)</td>
<td>Windsor (M2)</td>
</tr>
<tr>
<td></td>
<td>Napa (M3)</td>
<td>West Sacramento (M2)</td>
</tr>
<tr>
<td></td>
<td>Woodland (M2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citrus Heights (M2)</td>
<td></td>
</tr>
</tbody>
</table>

Next, the sample of six cities was stratified further to account for the participation dimension of each local hazard mitigation plan. In this study, local planning activity characterized by M1 or M2 participation models are treated as examples of plans created with low levels of public participation. Local planning activity characterized by M3 or M4 participation models are examples of relatively high levels of public participation. The matrix below (Table 42) shows the organization of sample cities based on the combined Fact Base and participatory planning criteria. Although there were no communities within the sample frame that fit in the low fact base score/high participation category, it does not mean that these types of communities do not exist. A valuable extension of this research study might include a number of case studies within communities that have done a great job at engaging and collaborating with public
stakeholders but have been able to incorporate information about social vulnerability into their risk assessments and final planning decisions.

Table 42: Final Case Study Selections

<table>
<thead>
<tr>
<th>High Fact Base Score (+)</th>
<th>High Participation</th>
<th>Low Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roseville (M3)</td>
<td></td>
<td>Citrus Heights (M2)</td>
</tr>
<tr>
<td>Napa (M3)</td>
<td></td>
<td>Woodland (M2)</td>
</tr>
</tbody>
</table>

| Low Fact Base Score (-)  | None Identified    | Windsor (M2)       |
|                          |                    | West Sacramento (M2) |

For the interview phase of this study, two plans were selected with high Fact Base scores and high participation levels, two plans were selected with high Fact Base scores and low participation levels and two plans were selected with low Fact Base scores and low participation levels. Within the larger sample frame there were no examples communities with plans that had low Fact Base scores and high participation levels. Figure 12 shows the locations of each case study city selected for deeper analysis.
Figure 12: Map of Case Study Communities

Summary characteristics of each of the six case study cities are presented in Table 43. The cities represent a range of Fact Base scores and participation models, as well as communities that have taken both single and multi-jurisdictional approaches to planning.
Table 43: Summary Characteristics of Selected Case Study Communities

<table>
<thead>
<tr>
<th></th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Roseville</td>
</tr>
<tr>
<td><strong>Planning Scale</strong></td>
<td>SJ (City)</td>
</tr>
<tr>
<td><strong>Participation model</strong></td>
<td>M3</td>
</tr>
<tr>
<td></td>
<td>Roseville</td>
</tr>
<tr>
<td><strong>Plan quality score</strong></td>
<td>13.25</td>
</tr>
<tr>
<td><strong>Fact base score</strong></td>
<td>4.32</td>
</tr>
</tbody>
</table>

*Interviewee Selection*

As discussed in Chapter 2, the conceptual framework that guides this study outlines a typology of stakeholder participants who are involved in the local hazard mitigation planning process. These stakeholders include official members of the hazard mitigation planning team, technical or subject matter experts, or local community/citizen volunteers. The interviewee selection methodology for the following six case studies draws from each of these core participant types.

Figure 13 diagrams the interactions through which key types of stakeholders participate in information production, goal setting and decision-making during local hazard mitigation planning. In order to identify the direction in which local hazard mitigation planning should go in the future, we must first understand the factors that affect the ways in which public and organizational stakeholders access, share and use...
local information. By interviewing participating stakeholders from the selected case study communities we were able to closely examine the conditions that spur various approaches to planning. In addition, we were able to identify why certain planning approaches lead to positive outcomes while others do not.

Figure 13: Models of Stakeholder Participation During Local Hazard Mitigation Planning

For the purpose of this study, the organizational stakeholder participant group includes technical experts, emergency managers, policy makers and consulting professionals who are directly involved in the local hazard mitigation planning process. The local community/citizen stakeholder group includes residents of the jurisdiction for which the plan was developed, representatives of neighborhood and community special interest groups (e.g. school groups, religious groups, environmental organizations, local historic preservation organizations, etc.) and local advocates, representatives and/or service providers for socially vulnerable groups. Stakeholders of this type are community
volunteers. In each case study city, in-depth interviews were also conducted with formal hazard mitigation planning team members.

Interviewees were selected using the saturation sampling technique. Organizational and community stakeholders were identified from the participant contact information recorded in each local hazard mitigation plan. All recorded participants in the planning process, including members of the mitigation planning team, outside consultants, and members of the public were contacted with a meeting request.

Additional participants were identified using the snowball sampling technique. Because the identities of many individuals were not recorded in planning documents, their contact information was more effectively obtained through referral from previous interview subjects. The snowball sampling technique was successful at identifying large numbers of individuals who were not formal participants during the local hazard mitigation planning process but who were key organizational or local community stakeholders behind the scenes during the planning process.

Data and Limitations

An important limitation associated with collecting information from participant interviews is that the self-reported data relies on memory, which has high potential for bias. Possible sources of bias related to memory include:

- **Selective Memory**: remembering, or failing to remember, experiences or events that occurred in the past;
- **Exaggeration**: representing outcomes or embellishing events as more significant than suggested from other data;
**Attribution:** attributing positive events or outcomes to one’s own agency while attributing negative events or outcomes to external actors; and,

**Telescoping:** recalling events that occurred at one time as if they occurred at another time.

In addition to the limitations associated with self-reported data, interviews cannot determine causal effects and their results are rarely generalizable to an entire group of stakeholders. Yin (2002), however, maintains that case study research has the power to generate valid findings when conducted systematically. In this study, the interview data (collected methodically through the use of interview guides), combined with documentary evidence (including planning meeting minutes, planning materials, newspaper articles and websites) and the proper application of qualitative data analysis software, allow for systematic comparisons to be drawn between stakeholder experiences that are based on factual evidence.

**Planning Scale and Participation during Local Hazard Mitigation Planning: Six Case Studies**

Between the months of June 2011 and November 2011, a total of forty-one stakeholders participated in interviews for this study. The interviews were conducted across the six cities and five counties. Thirteen interviews were conducted with stakeholders from the city of Roseville and ten interviews were conducted with stakeholders from the city of Napa. Six interviews were conducted with stakeholders from the city of Citrus Heights. The cities of Woodland and West Sacramento participated in a multi-jurisdictional planning effort and eight interviews were conducted
with planning committee members from these cities. Six interviews were conducted with planners and organizational stakeholders from the city of Windsor.

The interviews focused on understanding the experiences of three key stakeholder types during their participation with local hazard mitigation planning efforts in their community. Planning participants were asked for details about: (1) public participation and inter-agency collaboration during the local hazard mitigation planning process, (2) community contexts related to previous hazard events and mitigation planning activity, (3) successes related to the planning process, and (4) challenges related to the planning process. Time was also spent reviewing planning documents and compiling timelines to develop a detailed picture of the planning approaches adopted by each community. Information about each of the case study cities was supplemented by additional plans and reports about those communities. These resources (either provided by planning participants or collected from public web-based sources) provided important information about the histories and socio-political contexts of the case study communities.

Groups of interview participants from each community were made up of varied stakeholder types (Table 44). In Citrus Heights (n = 6), Woodland and West Sacramento (n = 8) over half of the interview participants were members of local hazard mitigation planning teams. In Windsor (n = 4), all of the interview participants were mitigation planning team members. In Roseville (n = 13), almost half of the interview participants were public stakeholders and in Napa (n = 10), 30 percent of interview participants were public stakeholders and local volunteers.
Table 44: Distribution of Participant Characteristics by Community

<table>
<thead>
<tr>
<th>Participants’ Attributes</th>
<th>Citrus Heights</th>
<th>Napa</th>
<th>Roseville</th>
<th>West Sacramento and Woodland</th>
<th>Windsor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organizational affiliation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consulting Company</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Organizational affiliation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>County/City Agency</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Business/Landowners/Resident</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NGO</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6</td>
<td>10</td>
<td>13</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td><strong>Role in Planning Process</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning Team member</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Technical Advisor</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Volunteer</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6</td>
<td>10</td>
<td>13</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>
Across the six communities, higher numbers of organizational stakeholders were identified and interviewed than were public stakeholders. This was true even after snowball sampling and collecting information about additional stakeholders from interview participants. As a result, higher numbers of organizational stakeholders and mitigation planning team members were interviewed than public stakeholders.

As expected, it was more challenging to identify public stakeholders from communities with plans characterized by low levels of public participation. Although the interviews did not include questions about plan quality scores or the results of the participation analysis, stakeholders from communities with low quality plans were less willing to participate in interviews than stakeholders from communities with high quality plans. A number of public stakeholders were frustrated with their experiences with the planning process and did not want to spend additional time talking about the plan. In the communities with the lowest quality plans, organizational stakeholders and mitigation planning team members were reluctant to share any details about their process at all.

NVivo 9 software was used to draw out themes and identify patterns in the interview data. Two conclusions emerged from the results of the previous quantitative analysis and prompted a deeper exploration:

1) Planning scale is a major driver of Fact Base score outcomes. Moreover, single-jurisdiction planning efforts produce higher quality plans than multi-jurisdictional efforts; and

2) Public participation in planning does not contribute to improved local hazard mitigation Plan Quality outcomes.
The qualitative phase of this study answers the why for the two statistically driven propositions above. To facilitate this process, the six case studies were organized into themes. The thematic organization allows for the close evaluation of patterns in community contexts and experiences that lead to specific planning outcomes. Moreover, it facilitates comparison between cases.

The first theme – Planning Scale – explores why planning scale emerged as a major factor responsible for the quality outcomes of local hazard mitigation plans. Based on the data and insights derived from the community interviews, a comparison of the Citrus Heights, Windsor, and Roseville case studies were selected as a lens through which to unpack the relationship planning scale and Fact Base scores within the study area.

The second theme – Public Participation – considers the beneficial planning outcomes associated with public participation that were not captured by Plan Quality metrics. Here, the case studies from the cities of Woodland, West Sacramento and Napa offer insight into the positive outcomes associated with collaborative public participation in planning.

Planning Scale: Single and Multi-Jurisdiction Local Hazard Mitigation Plans

The following analysis presents three case studies from the California communities of Windsor, Citrus Heights, and Roseville. The case studies include evaluations of a regional scale multi-jurisdiction hazard mitigation planning environment, a county scale multi-jurisdictional planning environment, and a city scale single jurisdiction planning environment. Together, the case studies help to clarify why
planning scale emerged as a major factor in determining the quality outcomes of local hazard mitigation plans.

*Regional Scale Multi-Jurisdiction Plan: Windsor, CA*

The Town of Windsor is located in central Sonoma County, twenty miles east of the Pacific coast. Windsor was incorporated in 1992 and at the time that the town’s 2009 local hazard mitigation plan was approved by FEMA, the population was approximately 25,158. Windsor has experienced a number of costly flooding events over the last twenty years that have damaged property and crops. Between 1990 and 2010 Sonoma County lost $356 million due to flood-related hazards. Additionally, because Windsor is located along the Healdsburg Fault, earthquakes present a considerable hazard concern for the community.

*The Plan*

After DMA 2000 was passed, Windsor created their first local hazard mitigation plan. In 2005, the Town Council adopted a resolution to partner with the Association of Bay Area Governments (ABAG) to update their local mitigation plan every five years. ABAG is a regional planning agency and Council of Governments that is governed by a 38 member Board. The Board, which is comprised of locally elected officials based on regional population, makes decisions, appoints committee members, authorizes expenditures and recommends policy for the region. All nine counties and 101 cities and towns within the Bay Area are voluntary members of ABAG, representing over seven million people.
Although ABAG members are not required to partner with the Council of Governments on planning projects, many communities, including Windsor, elected to develop their FEMA-approvable LHMPs under the guidance of ABAG’s multi-jurisdictional planning effort. Counties with previously secured FEMA mitigation planning grants (Contra Costa, for example) typically choose to hire planning consultants and create multi-jurisdiction county plans without ABAG’s assistance. However, based on information collected from planners from ABAG and Windsor, one of the key benefits of partnering with ABAG on their regional approach to planning was the opportunity to remain aware of what other communities in the region were doing to reduce their hazard risks. Additionally, by pooling their resources (including data, outreach materials, technical assistance, etc.) and holding planning meetings at the regional scale, local communities were able to save both time and money on their mitigation planning efforts.

The update of ABAG’s 2005 regional hazard mitigation plan officially began in 2009. Windsor submitted a letter of commitment to ABAG to participate in the regional hazard mitigation planning process in May. Soon after, representatives from participating jurisdictions across the region met at an ABAG-led mitigation workshop where they reviewed the comprehensive list of mitigation strategies outlined in ABAG’s 2005 plan and discussed regional priorities for each strategy. During the regional workshop, mitigation strategies were added, modified, and deleted based on participant recommendations.

Sixteen months later, The Town of Windsor reviewed the draft plan and submitted any comments related to the content of the plan to ABAG. At the same time, the Windsor Staff Review Committee (SRC), which consisted of representatives from the Town’s
various departments (and met twice a month as a communication team for development, construction and other Town related projects) oversaw the local review process for Windsor’s annex to the ABAG plan. A member of the SRC described their role in the planning process this way:

“Most often the Staff Review Committee drives new projects. We take a good look at new development projects without any public participation. It is an open forum for experts to talk and then their feedback goes back to the applicant and community with comments. The advantage is being able to talk without the public there.”

Once the draft mitigation strategies were agreed upon by the SRC, the Windsor annex was presented at a public Town of Windsor Planning Commission meeting and advertised on the Town of Windsor website. The majority of organizational stakeholders interviewed for this study expressed that the key purpose of Windsor’s public outreach effort was to meet FEMA requirements and to educate the community about general hazard risks. There were no attendees at the town meeting and no comments were received about the electronic draft of the plan.

In response to further questioning about the lack of public participation in the planning process, a member of the Windsor SRC mentioned that despite strong public interest and involvement in other local development projects, momentum for disaster related issues was nonexistent:

“Unless there is a specific project, we don’t get a lot of public participation. The downtown revitalization project is getting lots of public involvement and they have started thinking about the broader impacts of redevelopment projects on the community. But planners are not having really in-depth discussions with people [about hazards].”

The planning activity associated with Windsor’s 2010 plan annex is an example of a planning model that is low on the ladder of public participation. At the start of the plan
update process, public outreach was focused towards engaging local decision makers and organizational stakeholders through policy and planning workshops. Later, local jurisdictions were directed to engage their communities. Windsor and the other communities involved in the 2010 ABAG mitigation plan were informed that they must provide the public with at least two opportunities to comment before submitting the plan to FEMA and that ultimately it was up to them as to how they wanted to engage their community members.

One planning team member described local mitigation plans a waste of resources. Without mitigation planning, local resources could be reallocated to more meaningful projects, ones with greater potential to reduce risk and more appropriately address hazards in the community.

“There is tons of interest already in sustainability. We have been talking about the Sustainable Community Strategy lately with Cal EMA and I believe that hazards can be discussed and addressed here.”

“Climate change, sea level rise and climate change adaptation have become really salient issues. People are interested, but not so much in earthquakes. Maybe the phrase “hazard mitigation” is too techie or something.”

According to three organizational stakeholders, personnel changes in the local planning department diminished Windsor’s planning efforts to little more than a race to get the plan approved. One Windsor SRC member acknowledged that because the community leaned on other agencies to complete their local plan annex, there were many aspects of the plan development process that the community was not involved in.

Three of the four interviewed planning team members also expressed that the local mitigation planning requirement established by DMA 2000 was redundant.
“The whole hazard mitigation planning process that is required by FEMA is already done in the Safety Element of the general plan. It’s not new! Sometimes I think ‘why are we doing this?’

“I do think that there is a lot of value to a community evaluating their hazards and risks, but there is a lot of unnecessary duplication of efforts here.”

Out of the sample of thirty-four plans, the Town of Windsor’s annex to ABAG’s 2010 Mitigation Plan was the one with the lowest Plan Quality score. The plan scored lower than average on all three elements of Plan Quality and did not include any information about socially vulnerable communities in the hazard risk and vulnerability analysis. Additionally, the planning effort garnered limited public input and support. Although the interviews did not include a discussion about plan quality, very few members of the SRC and Town Council were willing to be interviewed about the planning effort and its outcomes.

As part of the plan update process, the Town of Windsor committed to updating their plan annex once every five years (as required by DMA 2000) by participating in ABAG’s multi-agency planning effort. In the event that ABAG is unwilling or unable to act as the lead agency in the multi-jurisdictional planning effort, the Town plans to contact other agencies in order to identify another regional forum for developing their local hazard mitigation plan.

County Scale Multi-Jurisdiction Plan: Citrus Heights, CA

Located in northeast Sacramento County, Citrus Heights is described as an economically significant suburb of the larger Sacramento region due to its thriving base of small businesses and its proximity to the region’s major highways and freeways.
Incorporated in 1997, Citrus Heights is surrounded by unincorporated industrial and agricultural lands and unincorporated residential communities.

Citrus Heights sits in a low lying delta with large floodplain areas. As a result, the community faces a variety of flood-related hazards. Although the city is situated within several drainage basins, the majority of streams in within the city limits remain unaltered and contribute to the natural riparian corridor. Two creeks in particular, Arcade and Cripple Creek, have relatively limited hydraulic capacities and are quickly exceeded during severe run-off events. In the past, this has led to overflow of stream banks and temporary inundation of the floodplain and adjacent low lying areas. In April of 1998, Federal Disaster Declaration was issued in the Citrus Heights due to flooding.

The Plan

Citrus Height’s 2004 LHMP was created as part of Sacramento County’s Multi-Jurisdictional Hazard Mitigation Plan. The County’s plan development process was facilitated by an outside consulting agency. Development of the multi-jurisdictional plan brought together the mitigation efforts of the county and eight municipalities. Rather than developing individual mitigation plans, the risk and vulnerability profiles of each of the eight participating communities were included in the larger county plan through chapters call “community elements.”

The primary purpose of the community specific elements in the plan was to address the DMA 2000 regulatory requirement that hazards with different degrees of risk across an entire planning area be evaluated separately. Additionally, the community
elements also separate flood and repetitive loss related problems and solutions for City and County Community Rating System purposes.

The community elements included short community profiles that summarized the capabilities, critical infrastructure and general plan elements that were relevant to local flood risk. The community elements also included lists of community-specific flood hazard mitigation recommendations that were identified by the multi-jurisdictional Hazard Mitigation Planning Committee. Citrus Heights’ community element did not include any contextual information about human vulnerability to hazards nor about ways in which the mitigation plan was tied into existing community regulations and programs.

The Hazard Mitigation Planning Committee, which was responsible for leading the multi-jurisdictional planning meetings, setting mitigation priorities and evaluating data, included representatives from:

- City of Citrus Heights
- City of Elk Grove
- City of Folsom
- City of Galt
- City of Isleton
- City of Rancho Cordova
- Sacramento County and
- 69 additional special districts and local government organizations within Sacramento County

Twenty-one citizens from jurisdictions across the county participated as members of Hazard Mitigation Planning Committee (HMPC). Despite the high number of public
stakeholders who were recorded as members of the HMPC, none of the stakeholders listed on the HMPC roster were residents (or employed within the city limits) of Citrus Heights.

During the early stages of the plan development process, the multi-jurisdictional HMPC held three meetings to discuss risk, vulnerability and hazard prioritization at the regional scale. Over the course of the planning project, five additional meetings were organized for the public. These meetings were designed to solicit feedback on multiple drafts of the plan. Prior to the public meetings, a draft of the hazard mitigation plan was posted on the Sacramento County website to provide the general public with an opportunity to review the document. Hard copies of the draft plan were made available for review at libraries, County Municipal Services Agency public counters, and at Sacramento City Hall. These public outreach strategies met the public participation requirements established by DMA 2000, however, no one attended.

One public meeting held in the City of Sacramento drummed up a number of comments concerning emergency response in the event of a levee breach and changing risk due to re-certification of the American River levee system. The levee-related comments were addressed in the Mitigation Action section of the hazard mitigation plan. No public comments were made at the remaining public meetings, including during the meeting held in Citrus Heights.

Organizational stakeholders across all planning roles expressed dissatisfaction in the lack of local community participation during the multi-jurisdictional planning effort. Two organizational stakeholder participants expressed that hazard mitigation was a difficult
topic to have with lay people at the table. Moreover, it was challenging for them to gain adequate public interest when communicating solely about hazards.

“We posted a draft plan on the county website. I was disappointed by the lack of knowledge of the general public but this was not the fault of anyone specific.”

The same stakeholders attributed the lack of public participation during planning to risk perception issues, the technical nature of hazard mitigation terminology, and the timing of the public meetings. In addition to achieving minimal levels of public participation in the planning process, the county-scale planning process did little to boost the knowledge of the public about hazards or to drum up public support for mitigation action.

The lone attendee of the two public meetings held near Citrus Heights, agreed to be interviewed for this study. The public stakeholder expressed extreme frustration with the content and quality of the meetings he attended.

“After attending two public meetings, I still know nothing about the community’s updates to the local hazard mitigation plan.”

“The first public meeting that I knew about was attended by one person from the public – me – one person from the County, and a planning consultant. I asked the consultant to for a hard copy of the plan or for a URL to an electronic version. She stated that it was in draft form and not yet available to the public. Then she showed a Power Point presentation that I did not understand. Why were they asking for public comments when the public was still being kept in the dark about the plan?”

The sparsely attended public meetings were criticized for being poorly organized and the topics presented by planning facilitators and agency representatives were described as jargon-heavy and difficult to understand. Despite his interest in participating in the planning process, the public stakeholder felt as though his community was poorly
notified about the public meetings and that he was provided with inadequate information about the relevance of the mitigation plan to his community.

“I do not know how much Sacramento County was paying the consultant for the public meetings, but in my opinion, $1 would have been too much for what was presented at the two public meetings I attended.”

The public stakeholder had not been informed about the 2011 Plan update process or about opportunities to participate further.

“You were able to contact me through information you obtained from the 2004 hazard mitigation plan and I do not understand why Sacramento County could not do the same for all of the time I volunteered with them on the preparation of the previous plan.”

Although only one public stakeholder interview was possible for the Citrus Heights case study, his responses and anecdotes highlight some of the shortcomings of the multi-jurisdictional approach to planning, especially as it relates to public engagement.

City Scale Single-Jurisdiction Plan: Roseville, CA

The City of Roseville is situated in the western foothills of the Sierra Nevada Range. Located within Placer County, approximately 16 miles northeast of downtown Sacramento, Roseville is the largest city within the county. Over the past two decades Roseville has experienced significant residential and commercial growth. Moreover, the community has attracted large amounts of industrial development and tech companies.

Roseville’s urban center consists of small single family homes, newer commercial and office space, and industrial development. Analysts anticipate that Roseville will continue to be the focus of significant regional development in the future. The focus of new development will be located primarily along the western, eastern and northern areas
of the community. At the time that the 2011 Roseville Multi-Hazard Mitigation Plan (RHMP) was approved, the city had an estimated residential population of 115,781.

The Roseville community is no stranger to disasters. The city lies within the boundaries of the Sacramento Metropolitan Area and borders on the Sacramento-San Joaquin Delta region, which has long history of flooding. Although the majority of previous losses to property and crops have been due to wildfire and flooding events, Roseville is also susceptible to seismic activity.

On April 28, 1973, a massive explosion erupted in the Southern Pacific Railroad yard near Roseville. A 21-car munitions train, carrying more than 7,000 bombs heading for Vietnam, caught fire and sent debris for miles into surrounding neighborhoods. The explosions began at 8:00 am and continued through the following day. The majority of the Roseville rail yard was destroyed in addition to surrounding buildings and homes. More than 350 people were injured. Although DMA 2000 does not require communities to assess their risk related to human-caused hazards, the City of Roseville includes human-caused hazards in their mitigation plan in part because of their experience managing the rail yard explosion in 1973.

In 1983, Roseville began participating in the National Flood Insurance Program (NFIP). The NFIP requires participating communities to follow two key guidelines: 1) all new buildings and major improvements to development must be elevated to or above the 100-year flood level, and 2) new developments within the floodplain are prohibited from increasing flood problems or damaging other properties.

Later, in 1991, Roseville joined the national Community Rating System (CRS), a voluntary incentive program for NFIP participating communities. The objective of CRS
is to reward communities that go above and beyond the minimum NFIP requirements to help their citizens prevent or reduce flood losses. The CRS provides incentives in the form of flood insurance premium rate reductions that increase in value according to the community’s CRS class. A community’s classification is based on the CRS credit a community receives for its eligible floodplain management activities. Class 1 is the highest CRS rating and requires the most points. Roseville became the nation’s first CRS Class 1 community and as of May 2012, it was the only Class 1 CRS community in the nation.

Previous hazard events have greatly affected Roseville’s approach to hazard mitigation. In addition to acquiring federal funds for local flood control improvements (including property buy-outs and freeboard projects), the 1995 flooding event generated substantial public support for taking an aggressive positive stance towards hazard mitigation activity. As a result, Roseville was able to swiftly and successfully link their land use and development planning with hazard mitigation projects. As explained by one Roseville Mitigation Planning Team member:

“Roseville is the most progressive city. The major flood in 1995 killed 12 people. President Clinton and the city manager walked through our town and vowed that this would never happen again. After the flood, all future land use was changed. No new development was allowed in the floodplain. When planning, they start by identifying all flood plains and now, before any new land is annexed by the city, we make all land in the flood plain open space.”

The 1995 flood, along with a collection of significant flood events in following years, laid the foundation for Roseville’s progressive regulatory environment, particularly in the context of flood risk reduction and land use planning.

The Plan
In addition to being the highest quality plan in the sample frame, the 2011 Roseville Hazard Mitigation Plan had the highest Fact Base score out of the 34 plans evaluated for this study. Roseville’s planning efforts also achieved the highest levels of public participation during planning within the sample frame.

Two distinct entities directed the development of the Roseville’s 2011 Hazard Mitigation Plan. Roseville’s hazard mitigation planning efforts were led in part by the technical expertise of a Planning Team made up of internal City staff and staff from a private consulting firm. In addition to the Planning Team, Roseville established a fifteen-member Steering Committee, made up of local citizens and staff from the city planning office. Generally, it was the responsibility of the planning team to produce the planning document and deliver it to the Steering Committee for feedback and approval. The Steering Committee was responsible for supervising the planning team and offering them with guidance throughout the various stages of the planning process.

The City of Roseville took the Steering Committee approach towards planning and decision making in order to meet CRS requirements related to the integration of Hazard Mitigation Planning with local flood risk reduction. Both the DMA 2000 and CRS are highly prescriptive and provide communities with crosswalks to facilitate compliance with program requirements and benchmarks. When asked about why the Roseville Planning Team approached the plan development process in the way they did, a Steering Committee member described CRS as a critical guide:

“CRS is a great way to guide public participation. It calls for the Steering Committee approach in which fifty percent of the committee must be made up of local citizens. Because DMA 2000 planning requirements are very similar to CRS it is easy for CRS cities like us to meet DMA requirements so long as we create a multi-hazard plan.”
Roseville’s Steering Committee was responsible for involving relatively large numbers of local stakeholders in the hazard mitigation planning process. The structure of the Steering Committee (as required by CRS) facilitated collaboration between planners, emergency management experts, and local stakeholders. All steering committee meetings were open to the public.

The role of the Steering Committee was not to identify mitigation actions. Rather, it was to develop and approve appropriate community outreach strategies, develop planning goals and objectives, to come up with a working definition of critical facilities in the community (in place of those defined by FEMA), and to serve as the local community spokes-body for the project. Two Steering Committee members described their main role during the goal setting and hazard prioritization process as critical listeners. Although not all of the hazard related information was new to them, a majority of respondents expressed satisfaction with the amount of new information they learned about hazards and disaster risks.

As equal members of the Steering Committee, citizen participants provided input to gauge public concern for specific hazards and vulnerable areas. Citizen members of the Steering Committee commonly expressed their lack of technical knowledge on the subjects of hazards and disasters. However, none of the six public stakeholder participants interviewed for this study described their lack of technical knowledge as a barrier to meaningful participation during the planning process. Respondents described community hazards education as an important, and necessary, goal of the participatory planning process. Public stakeholders spoke about their renewed sense of empowerment.
and responsibility for turning a local focus towards issues of flood control, reducing risk, and even towards changing local land use decisions.

“I don’t know much about risk and vulnerability. There were experts there who did. The simple fact that I was made aware of the risks, contingencies, and hazards was the main benefit and goal of my participation.”

“Now, I am motivated to maintain the current flood control system. There has been a great deal of turnover in the planning staff and committee membership, and the focus of mitigation projects has shifted to things other than flood control. I have taken it upon myself to keep steering focus back to flood control.”

In Roseville, all citizen members of the Steering Committee described some degree of personal and/or local empowerment as a product of the planning process. One participant described the plan a powerful tool for affecting local change:

“The point of the plan is supposed to be to gauge the public concern and to protect the public from risks in various ways. The long term goal is certainly to reduce risk and to ultimately change land use decisions.”

“A lot of plans just sit on the shelf and collect dust. In Roseville, we use our plans as weapons to fire politicians, to cite their bad development decisions and the public safety implications.”

Although Roseville is an example of a city that has been relatively successful at addressing the human aspects of disasters in their hazard risk and vulnerability assessments, half of the public stakeholders felt as through social vulnerability concerns were inadequately addressed during planning. Some felt as though concerns about vulnerable groups were completely left out of the conversation. Community stakeholders suggested that improvements to the City’s public outreach strategy may contribute to increased protection of vulnerable groups, particularly if the outreach activity occurs well before the start of the next plan update.
When responding to a question concerning their role on the Steering Committee, one of the organizational stakeholders described the planning professionals and emergency management experts as “puppeteers.” Although they were active members of the Steering Committee, they were slightly removed from the planning process, looking down from outside, and overseeing the development of public outreach strategies, mitigation catalogues, and community goals and objectives. They provided historical and institutional knowledge of the community and its neighborhoods from the land use perspective. They also helped maintain general plan consistency with broader city plans and policies.

In addition to forming a mitigation planning Steering Committee made up of fifty percent local citizen volunteers, Roseville took a number of focused approaches to public outreach that were designed to foster communication and information sharing within the larger community. Roseville’s public participation and outreach strategy consisted of a series of “Open Houses,” organized by geographic boundaries in an attempt to bring together stakeholders from adjacent neighborhoods with similar hazard risk profiles. At each Open House multiple members of the Planning Team and Steering Committee led a review of the risk assessment results and mitigation priorities with the public. Multiple organizational stakeholders were available to answer individual questions and to take advantage of impromptu educational opportunities with local community members.

The Steering Committee also developed a phone-based survey to gather information from the public about their perceptions of risk, vulnerability and mitigation priorities. The existing Roseville early warning auto-dial notification system was used to invite
subscribers to participate in the mitigation planning survey. The Planning Team and Steering Committee had an 18 – 19 percent response rate for the population.

In addition to meeting local CRS requirements and aligning mitigation goals with community priorities, organizational stakeholders belonging to Roseville’s Steering Committee mentioned that public participation during mitigation planning was necessary to educate the community and to drive plan implementation.

“A plan can be technically sound but it will go nowhere if there isn’t community support.”

“Ultimately, a really good outreach strategy makes for unbelievable feedback and response from the public. It is a great opportunity to educate people.”

“The ideal level of public participation is just enough to get community buy-in and to provide education about emergency preparedness, but not so much that it bogs down the process.”

The majority of Steering Committee members expressed that it was difficult to compel the public to participate in mitigation planning, particularly when the community has a number of other things to worry about. However, the same respondents were adamant that the benefits of public participation outweighed the costs associated with extending planning timelines and using resources for public outreach.

In addition to the strong public and political support for mitigation in Roseville, over half of the planning participants interviewed for the study spoke to the importance of local leadership and experienced consulting in determining the success of the city-scale planning effort.

“We had a very good consultant to spearhead the process. I can’t over-stress the importance of this.”

“It was the representatives from the hospital, local residential areas, and local businesses on the committee that really built the plan.”
The vision of the planning consultant kept the wind in the sails of the Planning Team and Steering Committee. Moreover, the quality of Roseville’s plan had a great deal to do with the access to resources, inter-agency relationships, and flexibility afforded by the single-jurisdiction approach to planning.

Results

The planning experiences of Citrus Heights, Windsor and Roseville offer considerable insight into why planning scale can affect the Fact Base scores of local hazard mitigation plans. In addition to establishing a smaller planning scope than multi-jurisdictional plans, single jurisdiction planning affords communities greater levels of control over all aspects of the planning process, including data collection, team building, and public outreach. In Roseville, the city-scale planning scope allowed for the planning team to build a steering committee that consisted of a representative sample of the community’s stakeholders. These stakeholders were important to the quality outcomes of the plan because they were able to bring information and details about the context and character of the community directly into planning.

One Steering Committee member from the City of Roseville offered advice to other jurisdictions that are in the early stages of developing or updating their local hazard mitigation plans:

“It is so important to get the right people on the steering committee. People are not going to participate that much, so it is vitally important to get a representative sample of the community’s stakeholders on the committee.”

“Some members of Roseville’s committee were on the emergency response team; others were hospital representatives from Kaiser and Sutter. These members are in the trenches and offer a great perspective on local vulnerability.”
Citrus Heights and Windsor had very little control over the creation of the multi-jurisdictional planning teams or over the logistics of the planning processes. Therefore, they were unsuccessful at engaging local leaders and stakeholders who could provide local perspectives on vulnerability and risk for use in the broader planning effort. In addition to having limited control over the makeup of their multi-jurisdictional planning teams, Windsor and Citrus Heights were beholden to pre-determined planning schedules agreed upon by their regional planning bodies and council of governments. Roseville, in contrast, had complete control over their local planning effort and was able to align mitigation planning milestones and activities with ongoing development programs and community events. This level of control was responsible for maintaining consistency of participation across planning meetings and contributed, in part, for the higher than average plan quality outcomes.

Based on the interview data and plan quality analysis, neither Windsor nor Citrus Heights was able to achieve high levels of public interest in hazard mitigation issues, nor did their plans include robust, contextual information related to the social vulnerability profiles of their communities. Despite these results, it is important to keep in mind that mitigation planning does not happen in a vacuum. Multi-jurisdiction planning unifies much of the planning effort (and distributes the cost) that goes into mitigation planning. Sometimes it makes more sense for a region, or a collection of communities, to join their planning efforts to carry out mutually beneficial mitigation planning activities at a lower cost.

Although the case studies suggest that single jurisdiction mitigation planning leads to preferable planning outcomes, single-jurisdiction planning may not be the appropriate
choice for every community. Communities can focus instead on the relevant and scalable best practices of communities that have been successful at creating high quality, implementable mitigation plans. Single-jurisdiction planning played a role in the success of Roseville’s planning effort. However, there were other aspects of the city’s planning strategy that contributed to their higher quality plan and increased community buy-in.

For example, Roseville’s Steering Committee was strategic in aligning their mitigation strategies with other municipal programs (i.e. Community Rating System). By highlighting the intersections between the steps required for CRS certification and FEMA’s multi-hazard mitigation planning process Roseville was able to leverage previously agreed upon and engrained community goals to achieve improved mitigation planning and action strategies.

In addition to integrating mitigation planning with existing local policies or projects, Roseville was able to bring the right local participants to the table and enlist strong leadership to reach local planning goals. This is another best practice that has the potential to improve multi-jurisdictional mitigation planning outcomes. The mitigation planning effort in Roseville was led by an experienced planning consultant and a committee made up of local leaders in the health, emergency response, and land use sectors. Multiple organizational and public stakeholders from the City of Roseville spoke about the benefits of working with an experienced planner and organizational stakeholders with years of experience working in the community. Strong leadership was paramount to determining what types of questions the Steering Committee asked in order to paint a clear picture of risk and vulnerability in the community.

Public Participation during Local Hazard Mitigation Planning
The results of the quantitative analysis indicate that public participation in the hazard mitigation planning process has no relationship to plan quality outcomes. The following case studies offer insight into the why of participation does not affect plan quality and they explore the unquantified effects of public participation on local hazard mitigation planning.

Although public participation does not affect plan quality scores, the literature supports the hypothesis that public participation in hazard mitigation planning is beneficial to plan implementation outcomes. Here we review the participatory processes of communities within the study area that have both high and low participation levels and investigate the effects of public participation (or the lack thereof) on hazard mitigation in those communities. The experiences of the following communities are examined in detail: Woodland, West Sacramento, and Napa.

**Low Public Participation: Woodland and West Sacramento, CA**

Located in California’s Central Valley, Woodland lies 20 miles northwest of Sacramento and is the county seat of Yolo County. Situated in an important agricultural region of the state, Woodland is surrounded on all sides by farm land. One of the fastest growing regions in the state, Woodland’s proximity to I-80 has subjected the city to significant growth pressures. To accommodate long-term projected growth, Woodland has plans in place to make additional land available for urban development, to continue infill development, and to encourage the re-use of underutilized lands.

The majority of Woodland lies within the existing FEMA 100 year floodplain. Valuable agricultural land and frequently inundated floodplains present very real physical
constraints to the city’s expansion plans. Over the past twenty years wildfire and high winds have caused the greatest damage to property while flooding and winter weather has been costly to both crops and property across the county.

West Sacramento is located at the eastern boundary of Yolo County in the Sacramento Valley. The city is bounded on its eastern, western and northern borders by water bodies, including the Sacramento River, the American River, and the Sacramento River Deep Water Channel and Yolo Bypass. The entire area of West Sacramento lies within the natural floodplain of the Sacramento River. The land is currently protected in part by levees and by the Yolo and Sacramento Bypasses, which divert floodwaters west around the city boundary. However, revised FEMA flood maps are expected to be released at the end of 2013 that will more accurately illustrate the flood risks in areas previously deemed safe due to the levee system. In addition to flooding, impacts from wildland and agricultural fires also pose a risk to the city.

The Plan

The cities of Woodland and West Sacramento both participated in the 2006 multi-jurisdictional Yolo County Multi-Hazard Mitigation Plan. A wide range of organizational stakeholders were involved in the development of the Yolo County Multi-Hazard Mitigation Plan. They included staff from public works, County emergency management officials, and local fire department staff.

An outside consultant was hired by the county to collect vulnerability data and evaluate risk for the county and the majority of the data collected for the local risk and vulnerability assessments was collected from federal sources. Information about local
history, including disaster declarations, damages and mitigation priorities were provided by each local jurisdiction and incorporated into the individual community elements of the plan.

Woodland and West Sacramento’s public outreach strategies consisted of two distinct efforts: 1) a risk perception questionnaire and 2) a public meeting. First, the cities distributed hard-copy questionnaires to residents to gather information about local priorities, preparedness and perceptions of risk. The questionnaires asked residents to rank their concerns about specific hazards and about their individual levels of preparedness. The questionnaires also provided residents with an opportunity to rank potential disaster mitigation policies and risk reduction actions by priority.

The two cities took slightly different approaches to distributing the questionnaires. West Sacramento posted the questionnaire on the city website. Members of the public were invited to print out the questions and send their responses to the hazard mitigation planning team. Rather than posting the questionnaires online, Woodland included copies of the questionnaire in residential utility bills. West Sacramento received 15 responses and Woodland received 889 responses. The data from the questionnaires was summarized by the County’s planning consultant and reported in the “Public Input” section of the plan. Although the questionnaires were able to draw out valuable contextual information from local communities, the data was not incorporated into the local risk and vulnerability assessments of the plans, nor was the information used to inform local mitigation goals and actions.

In addition to the surveys, Woodland and West Sacramento both held public information meeting to provide residents with an opportunity to review and comment on
the draft hazard mitigation plan. Details about the meetings were advertised in city newspapers and online. However, no public stakeholders attended the public meetings in either city.

Almost half of the organizational stakeholder participants expressed dissatisfaction with the outcomes of the public outreach efforts. Those who did cited a lack of resources as the key barrier to public participation during mitigation planning:

“We are missing the boat on a lot of things because we don’t have money, man power, or local attention. Other issues are more important to communities.”

“FEMA only sees public involvement during response. They should allow for a portion of every budget to be spent on one-on-one meetings with communities within each jurisdiction. As it stands, there is not enough money for more than one or two meetings.”

“The process is essentially a paper chase. For example, we want to do a threat assessment of emerging threats including socio economic and political risks but we don’t have the money.”

Both cities took a consultative approach to public outreach rather than a collaborative approach. Moreover, neither city used the information they gathered from the community to improve their plans. The information collected and shared from the public outreach efforts did not inform broader planning goals or mitigation actions in either city.

Although social vulnerability to hazards and disasters was not addressed explicitly in the Yolo County Hazard Mitigation Plan nor at the local hazard mitigation planning meetings, two organizational stakeholders from the planning team expressed concerns about the exclusion of social vulnerability from the planning process:

“Not one formula fits every community. We do need to understand demographics. Especially because they are changing so fast.”
“Census 2010 data show that we have a very high percentage of Latinos and Russian and Ukrainian immigrants concentrated in West Sacramento. We also have an older demographic of white European farmers. There is generally a large disinterest [in hazard mitigation] and we have language barriers.”

In contrast, two organizational stakeholders felt that despite rapidly changing demographics, socially vulnerable populations within the community were already very good at taking care of themselves. Additionally, these stakeholders expressed that social vulnerability analysis was outside of the scope of local mitigation planning activity:

“Many people have crossed the Mexican border to work as migrant workers. They are survivors. They can take care of themselves and are good at working the system. They are not interested in learning from us about hazard risks and mitigation.”

“We need to provide people with the truth: The cavalry isn’t going to ride in and save them. We need to give them an understanding of their risks, and we need to empower them to take care of themselves. Mitigation planning does not need to address these needs.”

Additionally, one organizational stakeholder commented that public participation was not necessary to contribute to a complete assessment of risk and vulnerability in a local community:

“The people and agencies engaged in planning are subject matter experts and fully understand the demographics of our area.”

“We know what people are at risk of. I don’t think that public input has led to a major impact in anything we would or would not have done.”

High Public Participation: Napa, CA

Incorporated in 1872, the city of Napa is located in Napa County the city straddles the Napa River in the southern portion of the Napa Valley. The city of Napa is roughly 50 miles northeast of San Francisco and 60 miles west of Sacramento. To the south of the
city lies agricultural and marshlands and the City’s northern edge consists of agricultural lands and vineyards.

Best known as a destination for wine lovers, the city of Napa became the primary business and economic center for the Napa Valley during the 20th century. A 1975 citizens’ initiative established a Residential Urban Limit Line (RUL) around the city that currently limits its outward growth. Napa is currently the largest city in Napa County and has a population of approximately 74,071 people.

Between 1990 and 2010, Napa County lost $436 million due to hazard events. Flooding, earthquakes and landslides have been the most prevalent (and costly) disasters in the County. By and large the largest losses to crops and property in the county over the last 20 years in have been due to flooding. The negative economic impacts of repetitive flooding led the residents of Napa to pass small tax increases to pay for flood mitigation activities.

The Plan

Napa’s 2009 local hazard mitigation plan (LHMP) was an update of the previous mitigation plan adopted in 2004. The City of Napa Hazard Mitigation Planning Team was tasked with updating the plan and developing an appropriate public outreach strategy. The Hazard Mitigation Planning Team was made up of representatives from the local fire department, Public Works, the Office of City Planning, the Water Department, and the Community Development Department.

The city of Napa’s hazard mitigation plan was characterized by high public participation and high Fact Base score outcomes. Napa’s LHMP was one of the only
plans in the sample frame that included information related to social vulnerability, including detailed information about populations living in group quarters, housing tenure, unemployment, per-capita income, and tourist populations. Although this information contributed to the LHMP’s higher than average Fact Base score, details about the importance of these factors as potential determinants of risk were not articulated in the plan.

Napa’s local hazard mitigation planning effort is an example of a highly participatory model of planning. A number of mitigation goals previously developed by local special interest groups (primarily the local fire prevention and flood mitigation groups) were integrated into the larger multi-hazard mitigation planning effort. The planning team actively sought input from these local stakeholders and special interest groups, and cultivated relationships built during previous planning efforts, to create continuity between the 2004 and 2009 mitigation plans. Moreover, information from local stakeholders was used to inform mitigation actions and goals for the plan update. Additionally, Napa was one of the only communities in the sample frame that achieved significant levels of attendance at community planning meetings and workshops.

One of the most engaged local community groups was “In Harm’s Way.” In Harm’s Way is a grassroots special interest group that was created in early 2006 after a catastrophic flood devastated Napa on New Year’s Eve 2005. Guided by the leadership of a lifelong Napa native, In Harm’s Way is driven by the donated time and money of Napa citizens. As stated by one member of In Harm’s Way:

“All you need to get invested quickly is a flood. After that, the community became really interested in the cause.”
When they were informed about the local hazard mitigation plan update, and about the call for public participation, In Harm’s Way volunteers jumped at the chance to contribute. They felt that the City’s flood-related planning efforts were years behind schedule and the group resolved to accelerate the completion of the plan through active participation “and persistence.”

“We signed petitions, went door to door, and did nothing by email. We did a lot of footwork and offered our comments and thoughts at every city meeting,”

From the perspective of the organizational stakeholders, In Harm’s Way was an important conduit through which community perspectives and priorities were brought to the table during the development of the City’s updated mitigation plan. Representatives from In Harm’s Way were at every city council meeting and every flood board meeting.

“They were always there,” recalled a city employee and Hazard Mitigation Planning Team member.

A prevailing sentiment expressed by a number of community stakeholders was that the participation of local communities in hazard mitigation planning was fundamental to both the quality of the planning process as well as the outcomes of the plan.

“Before we started attending city meetings, communication between the city and county was non-existent. As an invested group of locals we were responsible for getting the collaborative process going, getting communication between the city and county started, and getting people to work together.”

According to resident participants in the planning process, the Mayor of Napa stepped in to encourage consistent dialogue between community members and the hazard mitigation planning team. The Mayor told Napa residents to “keep her feet to the fire,” and urged the community to challenge the planning leadership and decision makers. Commented one Napa resident and In Harm’s Way volunteer.
“Our pushing made it better for everyone. Politicians have ego issues and power issues [...] we can do a lot more if we work with everyone.”

Despite the input from In Harm’s Way, organizational stakeholders from Napa’s Hazard Mitigation Planning Team reported that engaging the public in hazard mitigation planning was still a challenge, while bringing professionals together to talk about hazard mitigation was relatively easy. The organizational stakeholders and members of the Mitigation Planning Team were quick to acknowledge the significance of the strong public participation that they experienced during the local mitigation planning effort.

“Groups with a vested interest in Napa flood control issues approached us and significantly affected the prioritization of planning items in the LHMP.”

“The Napa Creek part of the mitigation plan wasn’t supposed to be completed for a few more months but it turned out ahead of schedule. Why? Because of a neighborhood group who spoke out and was very vocal. They provided very vocal persuasion and good arguments at city council meetings, and they definitely caused a change in priority setting.”

With respect to the ability of community stakeholders to provide the Planning Team with data and information related to vulnerable populations, the organizational stakeholders saw this as a core intention of fostering meaningful public participation. In Napa, the planning team solicited information about vulnerable populations during the early stages of plan development by reaching out to nonprofit groups and local social service organizations. In Harm’s Way also provided information about previous floods and about local losses and at-risk areas exposed by those events.

Napa’s organizational stakeholders wanted to create a hazard mitigation plan that they could hold themselves accountable to and that would be meaningful to the community. In their interviews, the organizational stakeholders described public participation as critical to making those goals a reality.
The importance of public participation as an educational opportunity also emerged as a strong theme among organizational stakeholders. Since the last major flood on New Year’s Eve 2005, the city has made it a priority to send people door to door to educate the public about their risks and about evacuation. One of the community planners remarked:

“Communication and information equal knowledge. Participation takes time, but unknowledgeable people are vulnerable people.”

Citizen participants also acknowledged the importance of their participation in the process based on new knowledge and capacity building. A number of public stakeholders expressed that they had learned a great deal from being brought into the fold of the local mitigation planning effort. Once community member commented:

“This was the first year that I did not need to sandbag. I moved here from the country and I’ve learned so much. Now, nothing in my basement is below four feet.”

Although public participation results in positive planning outcomes (including local flood risk reduction and increased preparedness), current Plan Quality scoring methodologies are unable to capture the myriad intangible benefits of participatory hazard mitigation planning including knowledge sharing, public empowerment, and trust-building. This study prompts us to question the usefulness of Plan Quality as a metric for assessing the success of local mitigation planning efforts.

Results

The West Sacramento, Woodland and Napa case studies provide a lens through which to examine variations in public participation in the context of local hazard mitigation planning. As indicated by the quantitative results of this study, high levels of public participation do not necessarily lead to higher quality hazard mitigation plans.
However, the Napa case study shows that public participation can play a critical role in driving public and political support for plan implementation and can turn the focus of mitigation actions towards vulnerable populations and at-risk communities.

From the very start of the data collection process, there was a stark contrast in the ability to identify, contact and engage with stakeholders in cities with low community participation levels versus those with highly participatory models. As was expected, fewer community stakeholders participated in planning within jurisdictions that carried out minimal public outreach and engagement efforts. Additionally, the enthusiasm of stakeholders about being interviewed, as well as their willingness to discuss the details of the mitigation planning process, was much more pronounced in cities with high levels of public participation. In highly participatory planning environments, enthusiasm about the planning process and its outcomes was expressed by interviewees from all three stakeholder participant groups.

Woodland and West Sacramento, both communities with low levels of public participation during planning compared to the other communities included in the sample frame, took a consultative approach to public outreach. Their efforts were characterized by low attendance at community meetings, communication breakdowns, and only mildly contextualized local mitigation planning documents. In Napa, where public participation was driven largely by the efforts of local special interest groups, not only was the planning team able to attract significant public interest in the planning process, but the mitigation plan is high quality as measured by the fact base, actions, and goals articulated by the plan.
In the city of Napa, the high level of public participation in mitigation planning activity was due in part to the existing social infrastructure built by the efforts of previous community-based planning initiatives. The most active community participants in the hazard mitigation planning process never thought of their activity as hazard mitigation. Instead, they described their participation as a product of their deep investment in Napa Creek related issues. These community participants asserted that it was their personal responsibility to do their research and engage with professional planners and decision-makers throughout the entire planning process. Ultimately, these actions led to increased political support for mitigation activity among local decision-makers and spurred the rapid completion of a long-awaited flood control project.

In addition to driving positive implementation outcomes and local support for mitigation activity, the case studies highlight the potential for public participation to turn the focus increased attention towards mitigation actions that benefit vulnerable populations and at-risk communities. In Woodland and West Sacramento, both organizational and community stakeholders acknowledged the changing demographic profiles of their communities as well as the difficulty associated with adequately assessing vulnerability issues related to language barriers and poverty. Public participation in these communities incredibly limited, and in some cases, planners articulated that vulnerable groups and at-risk populations (including minorities, immigrant groups, and impoverished families) could “take care of themselves.” Without increased interaction with at-risk communities, it is unlikely that future mitigation plans will include accurate interpretations about local coping capacity and social vulnerability.
In Napa, consistent interaction between the planning team, local representatives of social service organizations, and Napa residents prompted conversations about at-risk populations that occurred throughout all stages of the planning process. Information about vulnerable neighborhoods made its way into the risk assessment of the plan and, ultimately, into the mitigation strategies. The Napa case study indicates that without public participation, understandings about local social vulnerability are framed exclusively by the perspectives of organizational stakeholders. Communities that plan in the absence of collaborative, public engagement are at risk of establishing long term mitigation priorities that are based on misconceptions about local social vulnerability and capacity.

Discussion

The six case studies presented in this chapter examined an understudied area of planning related to public participation, planning scale and local hazard mitigation plan quality. By analyzing the nature of public participation during local hazard mitigation planning, and by providing an account of stakeholder experiences in relation to single and multi-jurisdiction planning environments, the case studies verify the importance of planning context in determining hazard mitigation plan quality outcomes.

Hazard mitigation planning is a dynamic process. Regardless of the jurisdictional scale at which local mitigation plans are developed, stakeholders with diverse perspectives and agendas can act together to incorporate local risk and vulnerability data into long term planning decisions. Findings from this study suggest that the engagement of public stakeholders in collaborative, participatory planning activity may not contribute
to higher quality mitigation plans. However, this study shows that in some cases the richness and diversity of public stakeholder perspectives engaged during local mitigation planning affects local preparedness levels, public buy-in, and political support for mitigation activity.

Similar to the way in which planners often act as information filters during the comprehensive planning process, local hazard mitigation planning teams filter information and knowledge collected from technical, public, and organizational stakeholders alike. Regardless of the amount of public participation and knowledge sharing that happens between the public and planning team members, the collected information and priorities still has to be passed through and approved by the planning team. Ultimately, the planning team decides on which hazards will be included in the plan. The planning team sets priorities for mitigation actions and establishes definitions for mitigation planning boundaries including critical facilities, community assets, and vulnerable populations. This reality may explain why participation does not relate to hazard mitigation plan quality or social vulnerability reduction. Moreover, it strengthens the conclusion that the planning team matters.

In communities where public stakeholders have been brought on as formal members of the mitigation planning team, mitigation priorities are closely aligned with local development priorities. Additionally, the planning efforts are associated with higher levels of public participation throughout the plan development process. In Roseville, the integrated planning team conceptualized and rolled out customized community engagement strategies that were dramatically more successful at eliciting jurisdiction-specific information about community needs, priorities, and vulnerabilities. In Napa, the
planning team leveraged existing community networks to reach out to and engage with members of the public who were not previously interested in or concerned about hazards. Not only did these efforts increase communicative and collaborative participation activity between local community stakeholders and the planning team, they strengthened the political palatability of local mitigation actions and led to increased individual preparedness.

Communicative planning processes include discourse, knowledge sharing and power-sharing. As an alternative to strictly technical approaches to planning, communicative planning fosters mutual understandings of under-represented priorities and stakeholder concerns. In the context of hazard risk reduction, communicative planning provides opportunities for resilience building and adaptive management to occur. However, communicative planning becomes increasingly challenging (and logistically infeasible) as the collection of planning stakeholders increases. Regional planning processes, for instance, must consider the needs and constraints of multiple jurisdictions, special interest groups, and publics. Very often, ambitious communicative planning strategies are scrapped for the sake of time and money. As seen from the communities profiled in this study, the hazard mitigation planning team is the heartbeat of the local hazard mitigation planning process. The mitigation planning team sets priorities, filters information, and designs community engagement strategies. Moreover, the planning team serves as a forum for communicative planning to occur regularly and often. By including public stakeholders and community leaders as formal members of mitigation planning teams, manageable boundaries are set around the communicative
process. What is more, this practice can be implemented in both single- and multi-
jurisdiction planning environments.

Variations in the planning outcomes of the case study communities were apparent
in terms of the local relevance of the plans (i.e. integration with current land use policy
and inclusion of information about local social vulnerability) and community support for
mitigation projects. Participants involved in single-jurisdiction planning efforts
articulated positive outcomes in the community including the timely implementation of
mitigation actions and renewed local commitment to mitigation in areas most vulnerable
to hazards. It was evident that the planning approaches in these communities had a
significant positive effect on the local acceptance of hazard mitigation projects.
Moreover, planning participants in these communities spoke about the importance of
consulting with residential stakeholders when identifying socially vulnerable populations
or at-risk infrastructure.

The public participation strategies and plan quality outcomes in cities that took
multi-jurisdictional approaches to planning were very similar. Based on the interviews
with community and organizational stakeholders, the cities of Citrus Heights, Woodland,
West Sacramento, and Windsor all took a consultative approach to public participation.
The outcomes were low public involvement, high dissatisfaction among community
stakeholders with respect to the plan, and low Plan Quality scores. Although Citrus
Heights, Woodland, West Sacramento, and Windsor all achieved FEMA approval for
their plans, the case studies indicated that their plans offered limited functionality with
respect to their lack of integration with local planning priorities. Although not articulating
positive outcomes may not necessarily indicate a lack of positive planning outcomes
participants might have known about successes but did not discuss them) very few of the participants involved in multi-jurisdiction planning efforts spoke positively about their experience (or about their plans) during the case study interviews.

In addition to planning scale, public participation was heavily influenced by previous local experiences with hazards and disasters. The case studies indicate that previous experiences with disasters and loss promote higher levels of engagement between organizational and community stakeholders during local hazard mitigation planning. This is consistent with other studies that have identified previous losses from disasters as an important driver of community participation in planning (Burby, 1998). Disasters open a window of opportunity in communities when, for a limited time, emergency management activity is propelled to the forefront of local priorities. During these windows of opportunity, the affected community is fertile ground for ambitious goal setting as priorities swing towards mitigation and prevention.

Personal experiences provided additional motivation for community members to engage in discussions about mitigation planning, as was evident in the communities of Roseville and Napa. Napa, for example, experienced its eighth flood in thirteen years on December 31st, 2005. In Harm’s Way, a community group that was created in response to the disaster, was instrumental in directing the City’s multi-hazard mitigation activities, primarily by getting local residents involved in planning. In Napa, the high level of public participation during all phases of planning was due in part to the existing social infrastructure built by the efforts of previous community-based planning initiatives to reduce flood risk. Moreover, the most active community participants in the hazard mitigation planning process never thought of their activity as hazard mitigation. Instead,
they described their participation in the planning process as a product of their deep investment in Napa Creek related issues. These community participants asserted that it was their personal responsibility to do their research and engage with professional planners and decision-makers throughout the entire planning process.

Local planning context does influence hazard mitigation plan quality. Although local social vulnerability factors did not affect plan quality outcomes, planning scale influenced the ability of local communities to customize their mitigation planning activity, engage local leadership, and, ultimately, create high quality plans. This study supports previous research that suggests that local mitigation plans prepared as part of multi-jurisdictional planning efforts often reflect minimal effort from participating jurisdictions in establishing unique vulnerability assessments or locally relevant mitigation measures (Schwab, 2011).

Comprehensive planning requires a strong correspondence between popular priorities, local needs, and government policies. Ultimately, planning for disaster resilience is no different. While the case studies presented here are unrepresentative of other contexts, the themes and observations highlight new directions in which mitigation planning research must go in order to clarify a framework for resilience-building. These questions include:

- Does the incorporation of social vulnerability data into risk and vulnerability assessments contribute to reduced local hazard risk?
- What can we learn from multi-jurisdiction mitigation planning environments where plan quality outcomes are high? and,
- Is plan quality an ideal benchmark for successful hazard mitigation planning? If not, then what metric is?
These questions, among others, are discussed in greater detail in the following chapter.
CHAPTER VI
CONCLUSIONS AND DISCUSSION

Introduction

This chapter synthesizes the key findings of this study and presents their implications for local hazard mitigation planning under the Disaster Mitigation Act of 2000. The strengths and limitations of this study are considered as well as key contributions to the literature. The chapter concludes with a reflection on the achievements related to the objectives of the study and presents directions for future research.

Building Disaster Resilience through Local Hazard Mitigation Planning

Hazard mitigation plans form the foundation for a community’s long-term strategy to reduce disaster losses and hazard risk. Not only is their purpose to identify policies and actions that can be implemented to reduce risk and future loss, but the planning process itself creates a foundation for risk-based decision-making and knowledge sharing.

The adoption of hazard mitigation planning as a cornerstone of U.S. emergency management was coupled with a turn towards local-level risk reduction strategies. Specifically, with the creation of FEMA’s Project Impact in 1997, and the passage of the Disaster Mitigation Act in 2000 (DMA 2000), a strong emphasis was put on reducing loss and risk through state, county, and municipal hazard mitigation planning efforts.

Since the passage of DMA 2000, researchers have been working to identify the impacts of local hazard mitigation planning efforts on disaster risk, property loss, and
vulnerability. Although measuring disaster prevention is a great challenge, empirical research has shown that high quality hazard mitigation plans have superior outcomes in terms of plan implementation and reduced vulnerability to hazards than do low quality plans (Burby et al., 1999; Brody, 2003; Godschalk et al., 2009; Beatley, 2009; Peacock et al., 2008). Additionally, plan quality studies grounded in the communicative planning literature have found that planning efforts that engage local stakeholders in participatory planning activities are the most effective at producing high quality plans and implementation outcomes (Bates & Peacock, 1989; McEntire, 2005; Smith & Wenger, 2006; Godschalk et al., 1999; Innes & Booher, 2010; Berke, Song, and Stevens, 2009).

The purpose of this study was to contribute to a better understanding of the role of public stakeholders during local hazard mitigation planning. An additional objective of this study was to examine how community characteristics (including demographics and planning scale) affect both plan quality and public participation.

This study evaluated the quality of thirty-four local hazard mitigation plans in the Northern California Bay-Delta region. It focused on assessing levels of public participation during local plan development and on identifying social vulnerability data in plans. This study measured hazard mitigation plan quality by scoring three equally weighted plan components included in a plan quality index. By incorporating social vulnerability metrics into hazard mitigation plan quality analysis, this study expands upon current plan quality assessment methodology to gauge how well local plans address the most at-risk members of their communities.

As a method for assessing and categorizing levels of public participation during planning, this study applied a conceptual framework grounded in the social-ecological
systems literature. The framework – refined by planning and social-ecological systems scholars Yli-Pelkonen & Kohl (2005) – brings together four planning models to illustrate a larger conceptual model of stakeholder participation during local hazard mitigation planning. This conceptual lens highlights the interactions through which stakeholders participate in information production, goal setting and decision-making during hazard mitigation planning (Callon, 1999; Yli-Pelkonen & Kohl, 2005).

Ultimately, the results of this study offer new insight into the effects of public participation and local community characteristics on mitigation plan quality outcomes. Across the sample of thirty-four plans assessed in this study, plan quality was consistently low with Fact Base scores scoring lowest across all three plan quality elements. The results of the quantitative analysis also found that community characteristics did not affect plan quality outcomes, nor did they affect levels of public participation during planning. In addition to these results, planning scale emerged as a key driver of plan quality outcomes.

This study is consistent with previous research and found that local mitigation plans prepared as part of multi-jurisdictional planning efforts struggle to establish customized vulnerability assessments and mitigation strategies that are integrated with local priorities and land use policies (Schwab, 2011). Moreover, the findings from the qualitative phase of this study are consistent with previous research showing that higher quality plans are created in planning environments where there are stronger interactions between public stakeholders, mitigation planning teams, and organizational stakeholders (Deyle & Slotterback, 2009). These results open the door to deeper, more focused
evaluations of local hazard mitigation planning conventions, a number of which are discussed at the end of this chapter.

Research Questions

In response to steadily increasing hazard vulnerability and losses from disasters, mitigation planning in the U.S. has shifted towards a local approach to goal setting and action development. This shift is due, in part, to increasing recognition of the benefits associated with multi-stakeholder knowledge sharing and with the integration of mitigation with broader community priorities and contexts.

Very few empirical studies have examined hazard mitigation planning in detail to identify key factors associated with superior plan quality outcomes. This study investigated the nature of public participation during local hazard mitigation planning in thirty-four California communities. It also identified key process-related factors that drive variations in plan quality and content. Data collection and analysis was organized into three methodological stages: a quantitative evaluation of plan quality; a factor analysis of community characteristics and plan quality; and a qualitative case study analysis. The key findings have been organized below by research question.

Research Question 1

What is the quality of local hazard mitigation plans created in the Northern California Bay-Delta region and to what extent has the public participated in the plan-making process?

Aim 1: To identify social vulnerability data in plans and incorporate that data into plan quality assessment metrics

Aim 2: To assess the involvement of community stakeholders during the planning process
Aim 3: To identify the participatory planning models employed by each city during the local hazard mitigation planning process

Based on the results of the plan quality analysis, hazard mitigation plan quality was consistently low across the sample of thirty-four plans. On a plan quality scale of 0 – 30 points, the mean plan quality score of the sample was 6.76 points. The highest quality plan in the sample, created by Roseville, CA, had a score of 13.25 points. The lowest quality plan, created by Morgan Hill, CA, had a plan quality score of 0.80 points.

Additionally, the fact base scores were the lowest scoring plan quality components across the sample of thirty-four plans included in this study. Very little information about local social vulnerability was included in the plans (as reflected by the results of the mitigation plan Fact Base scores). This suggests that contextual understandings and applications of local information were largely absent from the process of local hazard mitigation planning in the study area.

Levels of public participation during planning were low across the sample frame. Most communities took consultative approaches to engaging their public stakeholder in mitigation planning and their public outreach activities were characterized by one-way flows of information, flimsy surveys, and limited decision-making power by citizens. Over seventy-five percent of the communities evaluated for this study met FEMA’s public participation mandate by holding one to two public meetings and/or by posting an electronic draft of their mitigation plan online for public review. Over half of those communities reported having no attendance at their meetings and received no feedback from the community concerning the draft plan.
Research Question 2

How do community characteristics and levels of public participation affect mitigation plan quality outcomes?

Aim 4: To identify key relationships between local community characteristics (including population size, wealth, diversity, social vulnerability characteristics) and local plan quality scores

Aim 5: To analyze how community characteristics affect levels of public participation in local hazard mitigation planning

Aim 6: To evaluate how public participation in planning affects local hazard mitigation plan quality

The quantitative phase of this study produced four key findings: 1) no relationship was found between community characteristics and plan quality scores, 2) a factor named Racial Disparity, which loads highly on Race: African American and Race: Native Hawaiian or Other Pacific Islander, was associated with higher levels of public participation during hazard mitigation planning, 3) no relationship was found between public participation and plan quality, and 4) planning scale was a key driver of plan quality among local communities.

The results of the regression analysis demonstrated no associations between community characteristics and local plan quality scores (Aim 4). For example, communities that loaded high on the socially “At Risk” factor did not have higher (or lower) quality plans than communities with low levels of social vulnerability. The finding that plan quality did not differ between communities based on social vulnerability is important because it suggests that, despite limited planning resources and potentially divergent development proprieties, the most vulnerable communities in the study area were not systematically underserved by local planning efforts.
Although community characteristics did not influence plan quality as previously thought, mitigation planning activities in communities characterized by Racial Disparity (as represented by the two variables Race: African American and Race: Native Hawaiian and Other Pacific Islander) were associated with higher levels of public participation (Aim 5). It was not within the scope of this study to identify why certain stakeholders participate in hazard mitigation planning. However, future studies might explore the factors that explain increased participation in communities characterized by high levels of Racial Disparity in the context of hazard vulnerability.

In addition to satisfying Aims 4 and 5, the regression analysis also revealed that high levels of public participation did not drive mitigation plan quality outcomes in the study area, nor did they affect the Fact Base scores of local plans (Aim 6). In other words, public participation in planning did not lead to mitigation plans with greater amounts of social vulnerability data included in their risk and vulnerability assessments. These results are inconsistent with the initial hypotheses presented in this study. Further research is needed to clarify if/how communities can leverage local knowledge and social capital to reduce local hazard risk and vulnerability.

Ultimately, Planning Scale emerged as a key driver of plan quality outcomes and was found to have the strongest relationship to plan quality than the other variables included in this study. Specifically, the single-jurisdiction approach to local hazard mitigation planning was associated with higher plan quality scores. These findings (coupled with the results from the case studies) suggest that single-jurisdiction planning environments have been better able to produce customized vulnerability assessments, to develop mitigation strategies that are closely integrated with local priorities and land use policies, and to
engage the local public in education, goal setting and risk assessment. Not only do these results contribute new information to the existing body of hazard mitigation research, they spur new questions related to practice and policy surrounding regional and multi-jurisdiction approaches to local hazard mitigation planning.

Community Case Studies

The quantitative phase of this study contradicted an initial hypothesis that public participation contributes to higher quality mitigation plans. Additionally, the regression analysis exposed planning scale as a key driver of plan quality. The community case studies were conducted, in part, to clarify these results. Interviews and analysis were focused primarily on two understudied elements of local hazard mitigation planning: planning scale and public participation. In addition to evaluating the successes and failures of single and multi-jurisdictional planning efforts, the stakeholder interviews helped to identify unobserved outcomes associated with high levels of public participation during local hazard mitigation planning. Ultimately, the evaluation of the six community case studies drew out a number of key themes related to local hazard mitigation planning in the study region.

In case study cities with recent histories of hazard losses from disasters, higher levels of interaction and knowledge sharing occurred between organizational and community stakeholders during the hazard mitigation planning process. This is consistent with the existing literature and the factor analysis results, and can be explained by the theory of the post-disaster “window of opportunity.” During these windows of opportunity, mitigation activity is driven to the forefront of local priorities. Affected
communities are more inclined to engage in ambitious goal setting and information sharing. Within the case study communities, personal experiences motivated members of the public to engage in discussions about mitigation planning, as was evident in both Roseville and Napa.

Although the quantitative results of this study suggest otherwise, the models of participation that are utilized during local hazard mitigation planning matter to mitigation outcomes in a number of ways. The case studies reveal that the ways in which planning teams and organizational stakeholders engage with public stakeholders and share information play an important role in the ability of decision makers to garner public and political support for mitigation action. Additionally, public stakeholders who are engaged in communicative planning activities have more readily implemented individual preparedness measures and helped to maintained local momentum for hazard mitigation and local risk reduction activity.

One of the key conclusions of this study is that the composition of the local hazard mitigation planning team matters. Based on the results of the quantitative analysis, local public participation did not affect plan quality scores. However, the case studies revealed superior planning outcomes in communities where there were strong interactions between the mitigation planning team, organizational stakeholders, and local community stakeholders. Consistent with Deyle & Slotterback’s (2009) findings – which attributed positive planning outcomes to environments where interactions A and B in the Framework of Stakeholder Participation During Planning were equally strong – the Model 3 (M3) planning communities included in this study exhibited stronger local
support for the implementation of risk reduction actions, increased community preparedness, and increased risk awareness.

Figure 14: Revised Framework for Local Hazard Mitigation Planning

In communities with high levels of public participation, and high levels of social vulnerability information in their hazard risk assessments, not only were a broad range of stakeholder groups invited to participate in the planning process, public stakeholders and community leaders were delegated as formal members of the mitigation planning team. In some cases, fifty percent of the local mitigation planning team was made up of members of the public. Figure 14, a revised conceptual framework for local hazard mitigation planning, offers an alternative approach to public participation, one that supports communicative planning activity during local hazard mitigation planning regardless of planning scale.

In both Roseville and Napa, mitigation planning was characterized by continuous interaction between the Mitigation Planning Team, local community stakeholders, and
organizational stakeholders. Additionally, both communities took a delegated power approach to planning in which local community stakeholders were included as formal members of the Mitigation Planning Team. Unlike the conceptual framework presented in Chapter 2, this revised conceptual framework, interactions between local community stakeholders (vector B) are not conditional interactions. Rather, they occur throughout the life of the planning project and consist of two-way flows of information and knowledge sharing. Additionally, the revised conceptual model situates local community stakeholders at the center of mitigation priority setting and decision making. As was exhibited in Roseville and Napa, when local community stakeholders represent their communities as formal members of the hazard mitigation planning team they are directly involved in decision-making, priority setting, and definition development through a process of collaborative planning and knowledge sharing.

The revised conceptual framework provides local communities and planning regions with a useful approach to organizing their local hazard mitigation planning projects. Regardless of the jurisdictional scale of the planning effort, Roseville and Napa’s mitigation planning activity had long term effects on the community that were not evidenced in the other case study communities. These effects included increased public support for mitigation projects, increased political salience of hazards, and the close integration of mitigation goals and actions with local priorities and land use policy. Ultimately, the richness and diversity of public stakeholders engaged in local mitigation planning plays an important, yet little-understood role in determining local preparedness levels, public buy-in, and political support for mitigation.
The case studies also offered insight into why single-jurisdiction planning environments led to higher quality plans than those produced in multi-jurisdictional environments. First, those communities who took single-jurisdiction approaches to mitigation planning were afforded significantly more control over the planning process, including goal-setting, public outreach, and development of their mitigation planning teams. This enabled the single-jurisdiction communities to organize planning working groups that included local leaders and leveraged existing community relationships, to design community-appropriate public outreach strategies, and to align mitigation goals with existing community development priorities.

The large majority of the multi-jurisdictional planning efforts in the study region took a consultative approach towards public engagement. The outcomes of this planning approach included low public involvement, high dissatisfaction among the public with respect to the mitigation plan, and low Plan Quality scores. Although all of the multi-jurisdictional plans in the study area met the minimum requirements for FEMA approval, the case studies indicated that these plans were limited in their functionality due to their lack of integration with local planning priorities and a broader absence of public support for implementation.

When the Disaster Mitigation Act was passed in 2000, it represented a new approach to mitigation. Proponents emphasized its potential to boost local disaster resilience, mitigation capacity, and commitment through locally-driven approaches to planning. Additionally, DMA 2000 was designed to facilitate coordination between State, Tribal, and local entities to better link their unique mitigation planning and implementation efforts. Although the multi-jurisdiction plans analyzed in this study met
FEMA approval requirements, they missed the mark in terms of meeting the goals of DMA 2000. These results have important implications for communities who are planning for future catastrophes and want to foster local disaster resilience through mitigation planning and capacity building.

**Contributions and Directions for Future Research**

One of the key goals of this study was to contribute to our understanding of how mitigation planning can play a role in reducing hazard impacts and social vulnerability. The findings from this study add to a growing body of literature on hazard mitigation plan quality and local disaster resilience-building. This study confirms previous findings and contributes additional evidence that suggests public participation is beneficial to local hazard mitigation planning. Although public participation and local social vulnerability factors did not affect mitigation plan quality in the northern California Bay-Delta region, the relevance of public engagement during planning is clearly supported by the results of this study.

By taking a mixed methods approach, this study expands upon the existing body of literature and challenges conventional methodological approaches to plan quality assessment. While the quantitative phase of this study highlighted unseen relationships between variables of interest, the case studies provided rich details about those relationships and clarified the reasons why those relationships emerged in the study region.

In some cases, the findings from the two phases of inquiry were closely aligned, in others they were not. For example, the quantitative analysis helped to identify a strong,
positive relationship between plan quality and planning scale. Additionally, the quantitative analysis revealed that models of participation did not play a role in determining plan quality outcomes. The case studies allowed for the scrutinization of these findings and revealed that although participation may not affect plan quality scores, collaborative public engagement is incredibly valuable to mitigation planning in other ways. Additionally, the nuances between single- and multi-jurisdiction planning approaches were fleshed out by multiple conversations with planners, community members, and technical experts in communities of interest. The insights and findings related to planning scale would not have been possible without the addition of a quantitative approach. By coupling quantitative document analysis with qualitative case studies, this study (and its results) underscores the importance of context and process on the relative success of local planning efforts. As a result, this study brings in to question the exclusive use of plan quality as a barometer for successful planning, particularly in the context of hazard mitigation.

A limitation of this study is that the numbers of local hazard mitigation plans and community stakeholders interviewed were relatively small. Notwithstanding this limitation, the mixed methods approach may be applied to other communities and regions elsewhere in the United States. The sample size is within the minimum ratio of cases to independent variables for a regression analysis. Therefore, similar results can be expected, even if the sample size were scaled up significantly.

Despite its exploratory nature, this study contributes to new understandings of how to frame and measure the success of hazard mitigation plans. This work expands upon current plan quality assessment methodology to gauge how well local plans address
the most at-risk members of their communities. Despite acknowledgement of the importance of social vulnerability in the hazards and disaster literature and theory, previous research does not include social vulnerability in their hazard mitigation plan quality metrics. By incorporating social vulnerability concerns into the plan quality assessment, this study provides a new method for evaluating hazard mitigation plans that integrates theory related to disaster resilience.

For the first time, this study extracted key factors that represent underlying relationships between local demographics and hazard mitigation plan quality. This study found that the local social vulnerability profiles of communities do not play a role in determining the quality outcomes of local hazard mitigation plans. Unexpectedly, socially vulnerable communities do not necessarily have lower quality plans. This is a bit of good news, as it contradicts hypothesis that suggest that poor, marginalized communities have a lower capacities for planning.

Another result of this study shows that local social vulnerability is not statistically related to levels of participation during planning. This result has important implications for the potential for plan implementation in at-risk communities. It is critical that mitigation activities are implemented regularly in communities with elevated risk. By definition, socially vulnerable communities are more at risk to hazards than others. Plan implementation outcomes are positively associated with participation levels during planning. Therefore, it is important that socially vulnerable communities engage their publics in the mitigation planning process. This study indicates that public participation is low, regardless of local social vulnerability, and highlights an area for concern and focus.
for state and counties looking to reduce the vulnerability of their most at-risk jurisdictions.

Ultimately, this study illustrates that communities in the study area had very limited understandings of their local social vulnerability to hazards, even while they were developing their mitigation priorities and actions. This is problematic from the disaster resilience perspective. Although social vulnerability is complex and often eclipsed by the risks posed by physical hazards, it is one of the largest threats to local disaster resiliency. The body of research would benefit from additional analysis of plan quality and participation, specifically in socially vulnerable regions of the country.

While this study does not confirm that public participation during mitigation planning contributes to higher quality plans, it does partially substantiate the hypothesis that public participation contributes to local resilience through capacity building and increased local commitment to mitigation. Ultimately, this study brings in to question the relevance of plan quality as a metric for “good” hazard mitigation planning. As mentioned previously, the creation of high quality plans is not the end point in the mission towards reduced social vulnerability and losses from hazards. High quality hazard mitigations plans are an important intermediary step in the disaster risk reduction process for all communities. Ultimately, we are interested in an extension of these outcomes, including social vulnerability reduction.

The findings of this study bring to light several areas for future research. It was not within the scope of this study to test the relationship between the inclusion of social vulnerability information in planning risk assessments and changes in local hazard risk over time. However, a longitudinal study exploring the effects of social vulnerability
assessments on reduced local hazard risk would contribute greatly to current evaluations of “successful” hazard mitigation planning. Similarly, a longitudinal study of how public participation during hazard mitigation planning affects local social vulnerability over time would offer yet another way to evaluate planning success.

Another future research direction has to do with regional versus single-jurisdiction approaches to local mitigation planning. Hazards do not adhere to jurisdictional boundaries, especially those associated with climate change. Regional planning efforts have great potential to reduce hazard risks, especially risks from hazards that have large geographic extents. Moving forward, it is important that regional planning environments contribute to reduced local hazard risk to the same degree as local planning efforts. Future research may consist of case studies within multi-jurisdiction mitigation planning environments where plan quality outcomes are high to better understand the processes involved and to identify best practices.

If the opportunity arose to conduct this study again, I would situate this research study somewhere in the southern United States. Although California is an example of a progressive planning environment with a history of ambitious approaches to hazard mitigation, it is far more affluent and less socially vulnerable than most other parts of the country. More study of the relationships between plan quality, social vulnerability, and participation is needed in areas of the country that are faced with significant social risks and cultural disparities. Perhaps the relationships identified in this study would be more pronounced within the most disadvantaged and marginalized areas of the United States.

This study enhances our understanding of the current challenges facing local communities, planners and emergency managers related to local mitigation planning.
Taken together, the findings suggest a role for public participation in promoting hazard risk reduction in local communities. This research will serve as a base for future studies as they explore mitigation planning in the context of vulnerability reduction and resilience building. It also provides practitioners and local communities with a framework for managing and evaluating their ongoing mitigation planning activity.
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APPENDIX

INTERVIEW GUIDES

Section A (Used for organizational stakeholders)

Questions aimed at understanding the participant’s involvement in the LHMP development process:

1. What was your role during the local hazard mitigation planning process?
   a. What were the main tasks, responsibilities or duties that you undertook in that role?
   b. What other participants did you frequently interact with?
2. What do you consider to be you (or your organization’s) greatest contribution (or greatest potential contribution) to the development of the local hazard mitigation plan?
3. Who would you describe as the participant group most responsible for determining the direction of local hazard mitigation planning in your city?

Questions aimed at discovering the interviewee’s experience with public participation during the local hazard mitigation planning process:

1. FEMA requires a public participation element to be included in the development of the local hazard mitigation plan. Do you feel that your jurisdiction adequately met this requirement?
   a. In your opinion, what level of public participation is most appropriate in the context of local hazard mitigation planning?
   b. Were there challenges or barriers to achieving this desired level of public participation?
2. What were your jurisdiction’s public participation goals?
   a. Was there any specific information that the planning committee was hoping to glean from public participants?
3. Which members of the public were invited to participate and why?
   a. Please describe the opportunities that were made available for the public to participate in the planning process.
   b. Was anyone from the public not involved who you think might have contributed significantly to the planning process?

Questions aimed at understanding interviewee’s views about the fact base component of plan quality:

1. Were there unique benefits to including community stakeholders in the local hazard mitigation planning process?
   a. If yes, what are they?
   b. If no, why not?
2. Did any information related to the social or economic conditions in the local community emerge as a direct result of public participation?
   a. If yes, was this information used later in the planning process?
      i. If yes, how so?
      ii. If no, why not?
3. Did any information about local hazard risks or vulnerable populations emerge as a direct result of the public participation process?
   a. If yes, was this information used later in the planning process?
      i. If yes, how so?
      ii. If no, why not?
4. In your opinion, how did the public participation process affect the following stages of the hazard mitigation planning process?:
   a. Vulnerability and risk assessment?
   b. Goal setting?
   c. Identification of jurisdiction-appropriate mitigation strategies?
   d. Prioritization of mitigation actions?
5. In your opinion, did public participation affect the overall quality of your city’s hazard mitigation plan?
   a. If yes, in what ways?

Questions to allow the interviewee to provide additional information:

1. What improvements can be made to the public participation process?
2. Do you have any other comments that you would like to add with regard to your experience as a participant in the local hazard mitigation planning process or about the interactions between you and other participants during the process?

Section B (Used for community stakeholder participants)

Questions aimed at discovering how the interviewee was involved in the development of the city’s Local Hazard Mitigation Plan:

1. What was your role during the local hazard mitigation planning process?
   a. What were the main tasks, responsibilities or duties that you undertook in that role?
   b. What other participants did you frequently interact with?
2. What do you consider to be you (or the local community’s) greatest contribution to the development of the local hazard mitigation plan?
   a. Was there anything you were unable to contribute? Please describe.
3. Who would you describe as the participants most responsible for determining the direction of local hazard mitigation planning in your city?

Questions aimed at discovering the interviewee’s views about public participation in planning:
1. As a participating stakeholder in the hazard mitigation planning process, what motivated you to participate?
   c. What were your goals or desired outcomes for the hazard mitigation planning process?
      i. Were those desires realized?
      1. Why or why not?
   d. Was there any specific information that you hoped to share?

2. Please describe the public participation opportunities that were made available during the planning process.

3. Were there challenges or barriers to reaching your desired or expected level of participation in the planning process?

4. FEMA requires a public participation element to be included in the development of the local hazard mitigation plan. Do you feel that your jurisdiction adequately met this requirement?
   a. In your opinion, what level of public participation is most appropriate in the context of local hazard mitigation planning?

Questions aimed at understanding interviewee’s views about the fact base component of plan quality:

1. From your experience, are there unique benefits to including the public in the local hazard mitigation planning process?
   a. If yes, what are they?

2. Did any information related to the social or economic conditions of the local community emerge as a direct result of public participation?
   a. If yes, was this information used later in the planning process?
      i. If yes, how so?
      ii. If no, why not?

3. Did any information about local hazard risks or vulnerable populations emerge as a direct result of the public participation process?
   a. If yes, was this information used later in the planning process?
      i. If yes, how so?
      ii. If no, why not?

4. In your opinion, how did the public participation process affect the following stages of the hazard mitigation planning process?:
   a. Vulnerability and risk assessment?
   b. Goal setting?
   c. Identification of jurisdiction-appropriate mitigation strategies?
   d. Prioritization of mitigation actions?

5. In your opinion, did public participation affect overall quality of your jurisdiction’s hazard mitigation plan?
   a. If yes, in what ways?

Questions to allow the interviewee to provide additional information:
5. What improvements can be made to the public participation process?
6. Do you have any other comments that you would like to add with regard to local capacity, your experience as a participant in the local hazard mitigation planning process or about the interactions between you and other participants during the process?

INTERVIEW CODEBOOK

Node 1: Roseville or Citrus Heights (+,+)

I. Respondent Type 1: Organizational Stakeholder
   a. On HMPT
   b. Not on HMPT

   I. Level of public participation most appropriate
      a. high
      b. med
      c. low

   II. Public participation strategies?
      a. Public stakeholders on committees
      b. surveys
      c. town hall meetings
      d. websites
      e. newspaper articles
      f. PSAs

   III. Goals of Participation
      a. M1: manipulation, therapy
      b. M2: informing, consultation, placation
      c. M3: partnership, delegated power
      d. M4: community control

   IV. Unique benefits/value of participation?
      a. vulnerability and risk assessment
      b. goal setting
      c. identification of jurisdiction-appropriate mitigation strategies
      d. prioritization of mitigation actions
      e. public buy in
      d. education
      f. incorporation of local contextual information

   V. Challenges for public participation?
      a. public
      b. resources
c. institutional structure
d. time
e. other

VI. Did public participation affect overall quality?
   a. yes
   b. no

VII. Lessons for improvement?

2. Respondent Type 2: Community Stakeholder
   a. On HMPT
   b. Not on HMPT

I. Level of public participation most appropriate
   a. high
   b. med
   c. low

II. Public participation strategies?
   a. Public stakeholders on committees
   b. surveys
   c. town hall meetings
   d. websites
   e. newspaper articles
   f. PSAs

III. Goals of Participation
   a. M1: manipulation, therapy
   b. M2: informing, consultation, placation
   c. M3: partnership, delegated power
   d. M4: community control

IV. Unique benefits/value of participation?
   a. vulnerability and risk assessment
   b. goal setting
   c. identification of jurisdiction-appropriate mitigation strategies
   d. prioritization of mitigation actions
   e. public buy in
   d. education
   f. incorporation of local contextual information

V. Challenges for public participation?
   a. public
   b. resources
   c. institutional structure
VI. Did public participation affect overall quality?
   c. yes
   d. no

VII. Lessons for improvement?

Node 2: (+, -): Napa or Woodland

I. Respondent Type 1: Organizational Stakeholder
   a. On HMPT
   b. Not on HMPT

   I. Level of public participation most appropriate
      a. high
      b. med
      c. low

   II. Public participation strategies?
      a. Public stakeholders on committees
      b. surveys
      c. town hall meetings
      d. websites
      e. newspaper articles
      f. PSAs

   III. Goals of Participation
      a. M1: manipulation, therapy
      b. M2: informing, consultation, placation
      c. M3: partnership, delegated power
      d. M4: community control

   IV. Unique benefits/value of participation?
      a. vulnerability and risk assessment
      b. goal setting
      c. identification of jurisdiction-appropriate mitigation strategies
      d. prioritization of mitigation actions
      e. public buy in
      f. education
      f. incorporation of local contextual information

   V. Challenges for public participation?
      a. public
      b. resources
c. institutional structure
d. time
e. other

VI. Did public participation affect overall quality?
   a. yes
   b. no

VII. Lessons for improvement?

2. Respondent Type 2: Community Stakeholder
   c. On HMPT
d. Not on HMPT

I. Level of public participation most appropriate
   a. high
   b. med
   c. low

II. Public participation strategies?
   a. Public stakeholders on committees
   b. surveys
c. town hall meetings
d. websites
e. newspaper articles
f. PSAs

III. Goals of Participation
   a. M1: manipulation, therapy
   b. M2: informing, consultation, placation
c. M3: partnership, delegated power
d. M4: community control

IV. Unique benefits/value of participation?
   a. vulnerability and risk assessment
   b. goal setting
c. identification of jurisdiction-appropriate mitigation strategies
d. prioritization of mitigation actions
e. public buy in
d. education
f. incorporation of local contextual information

V. Challenges for public participation?
   a. public
   b. resources
c. institutional structure
VI. Did public participation affect overall quality?
   i. yes
   ii. no

V. Lessons for improvement?

Node 3 (-, -): Windsor or West Sacramento

I. Respondent Type 1: Organizational Stakeholder
   c. On HMPT
   d. Not on HMPT

I. Level of public participation most appropriate
   a. high
   b. med
   c. low

II. Public participation strategies?
   a. Public stakeholders on committees
   b. surveys
   c. town hall meetings
   d. websites
   e. newspaper articles
   f. PSAs

III. Goals of Participation
   a. M1: manipulation, therapy
   b. M2: informing, consultation, placation
   c. M3: partnership, delegated power
   d. M4: community control

IV. Unique benefits/value of participation?
   a. vulnerability and risk assessment
   b. goal setting
   c. identification of jurisdiction-appropriate mitigation strategies
   d. prioritization of mitigation actions
   e. public buy in
   f. education
   f. incorporation of local contextual information

V. Challenges for public participation?
   f. public
   g. resources
VI. Did public participation affect overall quality?
   e. yes
   f. no

VII. Lessons for improvement?

2. Respondent Type 2: Community Stakeholder
   e. On HMPT
   f. Not on HMPT

I. Level of public participation most appropriate
   a. high
   b. med
   c. low

II. Public participation strategies?
   a. Public stakeholders on committees
   b. surveys
   c. town hall meetings
   d. websites
   e. newspaper articles
   f. PSAs

III. Goals of Participation
   a. M1: manipulation, therapy
   b. M2: informing, consultation, placation
   c. M3: partnership, delegated power
   d. M4: community control

IV. Unique benefits/value of participation?
   a. vulnerability and risk assessment
   b. goal setting
   c. identification of jurisdiction-appropriate mitigation strategies
   d. prioritization of mitigation actions
   e. public buy in
   d. education
   f. incorporation of local contextual information

V. Challenges for public participation?
   a. public
   b. resources
   c. institutional structure
d. time
e. other

VI. Did public participation affect overall quality?
g. yes
h. no

VII. Lessons for improvement?