

## AN ABSTRACT OF THE THESIS OF

Stephanie Shepard for the degree of Master of Public Policy presented on August 16, 2016.

Title: “A Culture of Resilience”: Social Capital and Climate Adaptation in Post-Flood Boulder County, Colorado

Abstract approved: \_\_\_\_\_

Hilary Boudet, Chair

Scientists say that climate change is very likely to cause more frequent and more severe weather events. In order to understand how communities respond to changing weather patterns, an exploration of the connection between extreme weather events and climate change awareness, collective action, and policy is warranted. This case study of Boulder County, Colorado, uses 20 interviews with key informants, secondary interview data, 887 newspaper articles, materials provided by government and non-profit organizations, and direct observation to analyze the relationship between Boulder County’s September 2013 floods and climate change awareness and action. Findings indicate that climate change beliefs were not generally affected, but that the floods resulted in an overall heightened awareness of climate change impacts, as well as an increased focus on building resilience to climate change impacts, especially through the use of social capital. Findings also suggest that there was a complex relationship between social capital and resilience in post-flood Boulder County, Colorado. I conclude that municipal governments should network with the public to build resilience to climate change impacts, which would be more productive than attempting to increase public awareness of climate change risks.

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# “A Culture of Resilience”: Social Capital and Climate Adaptation in Post-Flood Boulder County, Colorado

By  
Stephanie Shepard

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APPROVED:

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Hilary S. Boudet (Chair), representing Sociology

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Lori Cramer, representing Sociology

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Bryan Tilt, representing Anthropology

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Stephanie Shepard, Author

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## TABLE OF CONTENTS

INTRODUCTION .....	1
LITERATURE REVIEW .....	2
Climate Change: public perceptions & scientific consensus .....	2
Extreme Weather and Climate Change Action.....	2
Collective Action.....	5
Climate Change Action & Resilience.....	6
Social Capital and Resilience .....	7
Networks and Social Capital Theory.....	8
Social Resilience and Marginalization .....	10
Research Questions.....	10
METHODS.....	11
Approach .....	11
Content Analysis.....	11
Interviews.....	12
Direct Observation .....	13
Data Analysis .....	13
FINDINGS AND ANALYSIS .....	13
Boulder County, Colorado .....	14
Climate Change Beliefs.....	16
Climate Change Awareness.....	16
Risk Perception.....	18
Building Climate Resilience .....	20
Climate Change Action .....	20
Resilience .....	23
Social Resilience .....	25
Bonding Social Capital: Access to Resources.....	27
Bridging Social Capital: Division and Marginalization.....	30
Linking Social Capital: Empowering Communities.....	33
Loss of Linking Social Capital .....	35
DISCUSSION.....	36

Areas for future research .....	40
Limitations.....	42
CONCLUSION .....	43
REFERENCES .....	45
APPENDICES .....	51
Appendix A: Interviewees .....	52
Appendix B: Interview Guide.....	53
Appendix C: Codebook .....	56
Appendix D: Areas in this study.....	57

#### LIST OF FIGURES AND TABLES

FIGURE 1: Map .....	15
TABLE 1: Groups that formed in response to extreme weather events.....	26

## INTRODUCTION

As climate change increases the likelihood of extreme weather events, it will become increasingly important to understand how communities respond to changing weather patterns. This research explores how the September 2013 flooding events in Boulder County, Colorado, affected community climate change beliefs and actions and how social capital was used to manage perceived risks associated with climate change. Social capital – defined as the resources that become available to people through their relationships with others – facilitates collective action (Kahan et al. 2011; Keys, Thomsen, and Smith 2016; Putnam 2000; Satterthwaite 2013) and plays a role in disaster preparedness and recovery (Adger 2003; Aldrich 2012; Marín et al. 2015; Pelling and High 2005), but there is still a need for research that explores the connection between social capital and climate resilience in a post-disaster context. My findings suggest that while climate change beliefs were generally not altered by the flooding event, risk perception did increase, and the community became more concerned with building climate resilience. Specifically, social capital was seen as a tool for building resilience to climate change impacts. In this essay, I discuss four different situations from Boulder County to demonstrate the complexity of the relationship between social capital and climate resilience. In these four situations, factors affecting the relationship between social capital and resilience included access to resources, social marginalization, community empowerment, and relationships between government and citizens.

I begin with a literature review about public perceptions of climate change, climate change impacts, awareness, and individual and collective action. Then I discuss scholarship on social capital in the context of extreme weather events and review the literature on climate resilience. Then, I describe my methods, offer a background of Boulder County, discuss my findings and analysis, and conclude with a discussion of policy implications.



## LITERATURE REVIEW

### Climate Change: public perceptions & scientific consensus

Although the planet has natural climate cycles, anthropogenic (human-caused) climate change is creating new hazards that threaten life on our planet. Extreme weather events are very likely to become more frequent and more severe (Pachauri, Mayer, and Intergovernmental Panel on Climate Change 2015). Anthropogenic climate change is real, it is significant, it is happening now, and it poses a threat to life on Earth (Farley 2008).

Despite the scientific community's consensus that anthropogenic climate change is occurring, popular opinion of climate change still lags behind the scientific consensus. A meta-analysis of 11,944 scientific papers indicated that over 97% of climate scientists agree that human activities are the primary cause of climate change (Cook et al. 2013). Public perceptions tend to fluctuate, but within the past few years, the percentage of Americans who believed in climate change increased. However, the percentage of Americans who feel that climate change is caused by humans has not increased (Leiserowitz, Maibach, et al. 2013; Leiserowitz et al. 2015, 2016). Even if public perceptions improve, knowledge is not sufficient for climate change action (Kahan et al. 2011), although scientifically based knowledge of the risks of climate change is needed for government planning and decision-making (Pachauri et al. 2015).

### Extreme Weather and Climate Change Action

The more action we take to address climate change now, the more likely we are to avoid the most severe future impacts (VijayaVenkataRaman, Iniyar, and Goic 2012). However, it is not clear what factors enable climate change action. For this reason, it is important to understand whether tangible impacts make a difference in factors such as awareness, beliefs, and risk perception, and whether more climate change action occurs after impacts.

Climate change is difficult to conceptualize because it is happening slowly and because there has never been another occurrence quite like it. It may seem too abstract and distant to provoke an emotional response (Weber 2006). According to Homer-Dixon (2006), “We...have great difficulty taking novel threats seriously because we tend to imagine the future through the lens of the past,” and, “our brains aren’t good at identifying, tracking, and acting on slow-creep problems” (p. 214-215).

Impacts can be an opportunity for experiential learning, which is more effective than learning from facts (Weber 2006). Experiential learning can lead to “affective” awareness, in which an individual has an emotional association with climate change, as opposed to facts, which lack an emotional “warning signal” and offer only an “analytic” understanding of climate change (p. 105). “Affective” awareness is a visceral fear that signals the need for action, as opposed to “analytic” awareness of climate change as a more distant, abstract concept.

Personal experience of an extreme weather event may increase risk perception – defined in this paper as the perceived likelihood and severity of an event – which could increase affective awareness and signal the need for climate change action (Weber 2006). Experiencing an impact can increase risk perception (Kellens et al. 2011), but it does not necessarily increase risk perception. Wachinger et al. (2013) found that some individuals who experienced impacts without personal damages underestimated the potential for future impacts and had a *decreased* risk perception. In addition to personal experience, a variety of factors could affect risk perception. For instance, social capital can cause households to feel better prepared and supported, and thus decrease risk perception (Babcicky and Seebauer 2016). Additionally, risk perception may not be the most important factor in climate change action; empirical studies show a weak relationship between risk perception and climate mitigation (Bubeck, Botzen, and Aerts 2012). Also, impacts do not necessarily lead to climate change awareness or action (Albright and Crow 2015; Wachinger et al. 2013).

Affective awareness can signal the need for climate change action (Weber 2006), but it is not sufficient for action. Affective awareness is essentially a form of fear, and fear of climate change can potentially result in denial and inaction (Dickinson 2009). Gilding (2012, p.xi) says that climate change denial can occur when people are “confronted with a problem so big that it requires you to change profoundly.” This can be an uncomfortable or threatening experience. In fact, simply discussing climate change can increase people’s thoughts of death (Dickinson 2009). When people feel fearful and threatened by these thoughts, they may suppress the thoughts by rejecting ideas that threaten their world view (Becker 1973). Dickinson (2009) found that efforts to repress this fear can still occur even when the efforts make the problem worse. For example, consumption could increase carbon emissions, but people may still consume if it helps them to repress the fear of climate change. In other words, awareness of climate change can have paradoxical effects on human behavior. Homer-Dixon (2006) explains, “When we're in denial, we can't think about the various paths that we might take into the future,” and goes on to state that denial will lead to inaction (p. 219). Dickinson agrees that denial can prevent climate change action. There is a contradiction that fear may be needed for action, but fear can also lead to denial and inaction. It cannot be assumed that climate change awareness leads to action.

Inaction or counterproductive actions may occur when the means for productive action seem unavailable or futile (Bubeck et al. 2012). And in fact, concern about climate change can decrease under these same circumstances (Norgaard 2011). According to Protection Motivation Theory, risk perception must be combined with the perceived ability to cope if it is to lead to productive action. An important element of the perceived ability to cope is termed “self-efficacy,” referring to an individual’s perceived ability to take action (Bubeck et al. 2012). But this theory falls short in that it de-emphasizes the role of social context and institutional factors in enabling action.

There is also conflicting information about the role of climate change knowledge and beliefs. Individuals who do believe in anthropogenic climate change are more likely to take actions to reduce their personal climate impact (Semenza et al. 2008) and to support climate change mitigation (Akter, Bennett, and Ward 2012). However, knowledge about climate change does not predict one's level of concern about climate change (Kahan et al. 2011), so the connection between knowledge and action is unclear. Surprisingly, awareness may not even be a prerequisite for action. A study found that in Colorado, actions taken to mitigate and adapt to climate impacts were *more* common among climate change deniers, leading to a question of whether beliefs are necessary (Brenkert-Smith, Meldrum, and Champ 2015). The study shows that the connection between beliefs and actions is more complex than it seems. A study looking at changes that occurred after an extreme weather event could help to bring some clarity to the theories of climate change beliefs, risk perception, and action.

### Collective Action

Collective action is central to environmental decision-making because natural resources are collectively shared. In a climate change context, it is important because collective action has greater potential to make an environmental impact. Studies often focus on the individual level when exploring drivers of climate change action (Norgaard 2011). Understanding collective responses to climate change is a greater challenge (Keys et al. 2016). It cannot be assumed that the research about individual climate change behaviors extends to collective behaviors, but social context could help to explain individual responses to risk (Lo and Cheung 2016). Research exploring collective behaviors in response to climate change risks and environmental management tends to focus on the role of institutional, social, and cultural context. Collective responses to climate change are affected by factors such as cultural values about the environment (Kahan et al. 2011), or local government's receptiveness to grassroots groups (Satterthwaite 2013). Cooperative relationships between citizens and government "promotes the

adaptive capacity of societies to cope with climate change” (Adger 2003, p. 397) and supports disaster recovery (Marín et al. 2015). Extending the “self-efficacy” component of Protection Motivation Theory, social and institutional context may also provide the resources that individuals need in order to act.

Empirical research exploring the effect of extreme weather events on collective behaviors related to climate change is limited. In seeking to further the scholarship on this area of research, I set out to explore how impacts from an extreme weather event affected climate change beliefs and behaviors in Boulder County, Colorado. My research led me to an exploration of the use of social capital in building climate resilience in a disaster recovery context.

### Climate Change Action & Resilience

The relationship between social capital and disaster recovery has been gaining attention from scholars in recent years (Aldrich 2012). I have sought to contribute to this body of research by exploring social capital and collective behaviors in a disaster recovery context. When looking at factors that are associated with recovery from disaster, most researchers have not considered the value of social capital. Aldrich claims that social capital is “the core engine of recovery” for communities – even more important to disaster recovery than economic resources, amount of aid money, government response, agency assistance, or level of damage (Aldrich 2012 p. 15). An understanding of social capital’s role in disaster recovery can help decision-makers to utilize its benefits, whereas disaster response that does not recognize its role may “actually damage social capital” (p. 17), ultimately reinforce vulnerability, and hinder disaster recovery (McCarthy 2014).

Social capital is also increasingly making its way into the literature on resilience, including resilience to climate change impacts. The social capital framework can be used to gain insight into the complexities of building resilience (Pelling and High 2005). Social capital is often described as a

characteristic of resilience, but few studies analyze the complexity of the relationship between social capital and climate resilience, especially in a post-disaster context (Jordan 2015).

### Social Capital and Resilience

Social capital is recognized as a way for communities to manage environmental risk (Adger 2003) and build adaptive capacity (Pelling and High 2005). Among the many risks to humans, climate change may cause marginalization and population displacement (Fleming 2009; Pachauri et al. 2015), which can damage social capital and result in long-lasting negative effects for individuals and communities (Tilt and Gerkey 2016). Low-income populations are particularly vulnerable to climate impacts (Crimmins et al. 2016; Pachauri et al. 2015). Multiple extreme weather events – made more likely by climate change – compound these impacts (Crimmins et al. 2016). Parr (2012) says that social equality is a central issue to climate change because, “it will be the poor...who will bear the greater burden” (p. 21). Impacts that disproportionately affect vulnerable groups can be considered the opposite of resilience since they reveal an inability to adapt and affect the overall composition of the community (Adger 2000; Sapirstein 2006; Satterthwaite 2013).

Resilience is conventionally defined as the ability to “bounce back” from shocks and to adapt to changing conditions in order to maintain quality of life. Moreover, it may be thought of as the ability to “bounce forward” into a new normal and adapt to changes induced by shocks (Cox and Perry 2011; Sapirstein 2006; Walker 2006). Climate resilience is a relatively new area of scholarship, but the definition generally includes the ability to absorb, recover from, and prepare for extreme weather events and other shocks that are likely to be associated with climate change (Satterthwaite 2013). Many factors contribute to resilience, including but not limited to infrastructure, warning systems and evacuation plans, emergency management, and local governance. Typically, the primary focus of disaster preparedness is on physical resilience and investment in stronger infrastructure, such as roads,

bridges, buildings, and facilities designed to withstand impacts. Social resilience is often overlooked, even though it is necessary for overall resilience (Aldrich and Meyer 2015). However, scholars warn against assuming that social capital leads to resilience, especially in a climate change context, because this assumption could result in an unintentional reinforcement of social marginalization, vulnerability, and resource imbalances during a disaster (Jordan 2015; McCarthy 2014).

Social resilience is defined as “the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change” and it is closely tied to social capital (Adger 2000). As the frequency and intensity of weather events increase, more communities will likely face the challenge of disaster recovery and will need to consider the role of various types of resources. Social capital is a type of resource that can help to build adaptive capacity, or resilience, in response to these impacts (Keys et al. 2016).

Scholars have found that facilitation of collective action and social change are among the many social and economic benefits of social capital (Putnam 2000). But in order to be effective, collective action needs, “receptive political systems with the capacity both to respond to citizen demands and to learn” (Satterthwaite 2013 p. 388). Because local government is able to interact with citizens and understand local context, it is instrumental in facilitating climate resilience. The adaptive capacity of local government is reflected in its ability to respond to pressure from citizens, work with local groups, and understand vulnerabilities (Satterthwaite 2013).

## Networks and Social Capital Theory

The concept of social capital originates with Sociology pioneers Emile Durkheim, Max Weber, and Karl Marx, but the concept made its way into popular culture after Robert Putnam wrote *Bowling Alone: The Collapse and Revival of American Community* (2000). Social capital is a type of resource that can be used to assess the value of relationships based on trust and reciprocity to an individual, a

community, a region, or a country, and it includes relationships between citizens and government (Bourdieu 1986; Coleman 1988; Szreter and Woolcock 2004). There is no unified definition (Tzanakis 2013). This paper uses the definition that Aldrich (2012) uses, which is, “resources available to people through their connections to others” (p. 2). I chose this definition for its simplicity and for its applicability to this case study. I also chose this definition because my study is largely informed by Aldrich, who has written extensively on social capital and disaster recovery using a public policy lens.

One common social capital framework divides social capital into three types, which include bridging, bonding, and linking. This framework has been used to study the role of social capital in disaster recovery (Hawkins and Maurer 2010) and collective action (Bell 2016). Bonding occurs between individuals who have similar characteristics, such as socioeconomic status, race, or ethnicity. Bridging occurs between groups with different characteristics. This distinction helps to differentiate between networks that serve large heterogeneous groups and those that serve small homogenous groups (Adger 2003). Narayan-Parker (1999) says that bonding social capital is beneficial to members of a group, but weak bridging social capital may isolate different groups from each other. Bridging social capital forges connections across different groups, reducing the likelihood that, “social differences will grow into divisive social cleavages” (p. 13). Linking social capital refers to relationships that occur across different levels of power, such as citizens’ relationships with local government, nonprofits, or other institutions (Szreter and Woolcock 2004).

Networks are the essential building blocks of social capital. According to Milward and Provan (2006, p.16), “The goal of the network is to build social capital so that communities will be better able to deal with a variety of problems.” In other words, social networks can help to build resilience to current and future problems. In fact, robust social networks are themselves characterized by resilience. They are tolerant of disruptive events and impacts due to a complex level of interconnectedness (Barabási 2003).



Since robust social networks are able to withstand shocks, they are essential for resilience during shocks (Aldrich 2012).

### Social Resilience and Marginalization

Despite its role in building resilience, social capital is said to be a double-edged sword. Although social capital is often assumed to be a public good that distributes benefits equally (Paxton 1999; Tzanakis 2013), it can deliver negative externalities to those who do not possess it. One reason social capital is a useful theory is due to its implications regarding social marginalization and vulnerability (Pelling 1998; Woolcock 2001). Aldrich (2012) took the idea of negative externalities in social capital to the field of disaster recovery. He concluded that groups with greater levels of social capital can suppress the recovery of excluded or marginalized individuals.

A criticism of social capital theory is that it discourages analysis of larger social and political problems. According to critics, framing relationships as a resource or as a form of capital shows that neoliberal ideology has “decisively permeated social and political discourse.” Due to the emphasis on social capital as a resource, it has been argued that social capital theory neglects analysis of the structural forces that cause inequality (Ferragina and Arrigoni 2016 p. 4). However, one advantage of thinking of social capital as a type of resource is that it allows for a comparison of its role relative to other types of capital, such as financial capital. According to Putnam, “Financial capital – the wherewithal for mass marketing – has steadily replaced social capital – that is, grassroots citizen networks – as the coin of the realm” (Putnam 2000, p. 40). That comparison could help to reveal structural problems by offering an alternative way to analyze inequality (Pelling and High 2005).

### Research Questions

There is a need for a more comprehensive understanding of factors that enable collective climate change action. There is also a need for a better understanding of the connection between social

capital, climate change action, and climate resilience. To explore these areas, I used the following research questions: 1) How did community leaders in Boulder County perceive the relationship between the September 2013 flooding events and community climate change beliefs and actions? 2) Among community leaders, what was the perceived role of social capital in building resilience to climate change after the September 2013 flooding in Boulder County?

## METHODS

I used interview data, newspaper articles, documents, and direct observation to analyze community reactions to the September 2013 flooding in Boulder County, Colorado. I selected Boulder County due to the severity of the flooding and because its unique social, cultural, and political context could provide theoretical insights that would not be provided by more representative settings.

### Approach

This study warrants a qualitative methodology due to the multidimensionality of social capital (Bell 2009). Additionally, the problems with quantitative measurements of social capital (Tzanakis 2013) make it, “inherently difficult as a subject for precise empirical measurement” (Szreter and Woolcock 2004, p. 655). Social resilience is also suited to qualitative methods due to its lack of a consistent definition (Sapirstein 2006) or consistent indicators (Adger 2000). Qualitative methods offer a nuanced understanding of relationships and mechanisms, as well as a more holistic understanding of processes related to evolving attitudes and beliefs (Babbie 2009). Qualitative methods are also appropriate for a grounded theory approach (Robson 2011).

### Content Analysis

I read 887 news and opinion articles published in *The Daily Camera*, the daily newspaper of Boulder, Colorado, and the *Times-Call*, the daily newspaper of Longmont, Colorado, published between September 8, 2013, and September 8, 2014. Articles were retrieved through the NewsBank database

using the key search term “flood”. I coded the articles to identify community characteristics, policy changes, discussions of climate change, and environmental actions, and key actors. I also read the following documents: the City of Boulder’s resilience strategy draft for public comment, the Resilient St. Vrain project Web site, a document that summarized community research conducted by BoCo Strong, and materials that were distributed during a community meeting I attended on February 22, 2016.

## Interviews

I recruited key participants through a purposive sampling method until saturation was reached (Robson 2011). Key participants include survivors, government representatives, nonprofit leaders, grassroots organization leaders, and others who were involved with the community (See Appendix A: Interviewees). I conducted semi-structured interviews with 11 individuals in person and phone interviews with nine individuals. Of the 25 individuals I initially contacted by e-mail, 20 responded. Two declined, and two others connected me with qualified individuals who would participate. A total of 20 individuals from Boulder County participated in 18 interview sessions. The average duration was 55 minutes, with a minimum of 24 minutes and a maximum of 80 minutes. Interviews occurred between February 22, 2016, and April 29, 2016. Interview questions were designed to elucidate changes that occurred after the floods, including community mobilization; policy; social, environmental, and political issues; and climate change perceptions. (See Appendix B: Interview Guide). I also used interview data from the Maria B. Rogers Oral History Program at the Boulder Public Library to understand community reactions in the weeks and months immediately following the flooding event. I reviewed these interviews in order to check for consistency against the data I collected and to assess potential validity threats (Maxwell 2005; Patton 1999).

## Direct Observation

On Monday, February 22, 2016, I attended a public meeting at the Boulder Public Library, hosted by Resilient Boulder in partnership with BoulderTalks and CU Boulder. Community members gathered in groups to brainstorm and discuss resilience. The discussion was used to guide Boulder's resilience strategy. I used data collected during this event to gain insight about resilience in Boulder.

## Data Analysis

I collected audio recordings and wrote memos during interviews, immediately after interviews, and during transcription and coding to stimulate insights and identify themes. I edited transcripts for clarity and relevance. I utilized grounded theory on the transcripts to generate a theory to explain processes that occurred after the floods. This involved the use of open coding and axial coding techniques (Robson 2011), which allowed me to identify emergent themes and generate meaning (Hesse-Biber 2011; Miles, A. M. Huberman, and Saldaña 2014; Robson 2011). I cross-referenced findings with transcripts, memos, and coded files to ensure accuracy and consistency (Miles et al. 2014). I developed a codebook to use as a guide during the coding process (See Appendix C: Codebook). I selected social capital theory after noticing that my emergent themes corresponded with the bridging, bonding, and linking framework.

## FINDINGS AND ANALYSIS

I initially set out to understand the relationship between the September 2013 flooding in Boulder County and community climate change beliefs and actions, as understood by community opinion leaders. It soon became apparent that there was a change in climate change risk perception and a greater focus on building resilience. This finding resulted in a second research question, in which I asked how community opinion leaders conceptualized building climate resilience. The Findings section

begins with a background of Boulder County and the extreme weather events. I first discuss how climate change perceptions were affected. Then I discuss findings related to social capital and resilience.

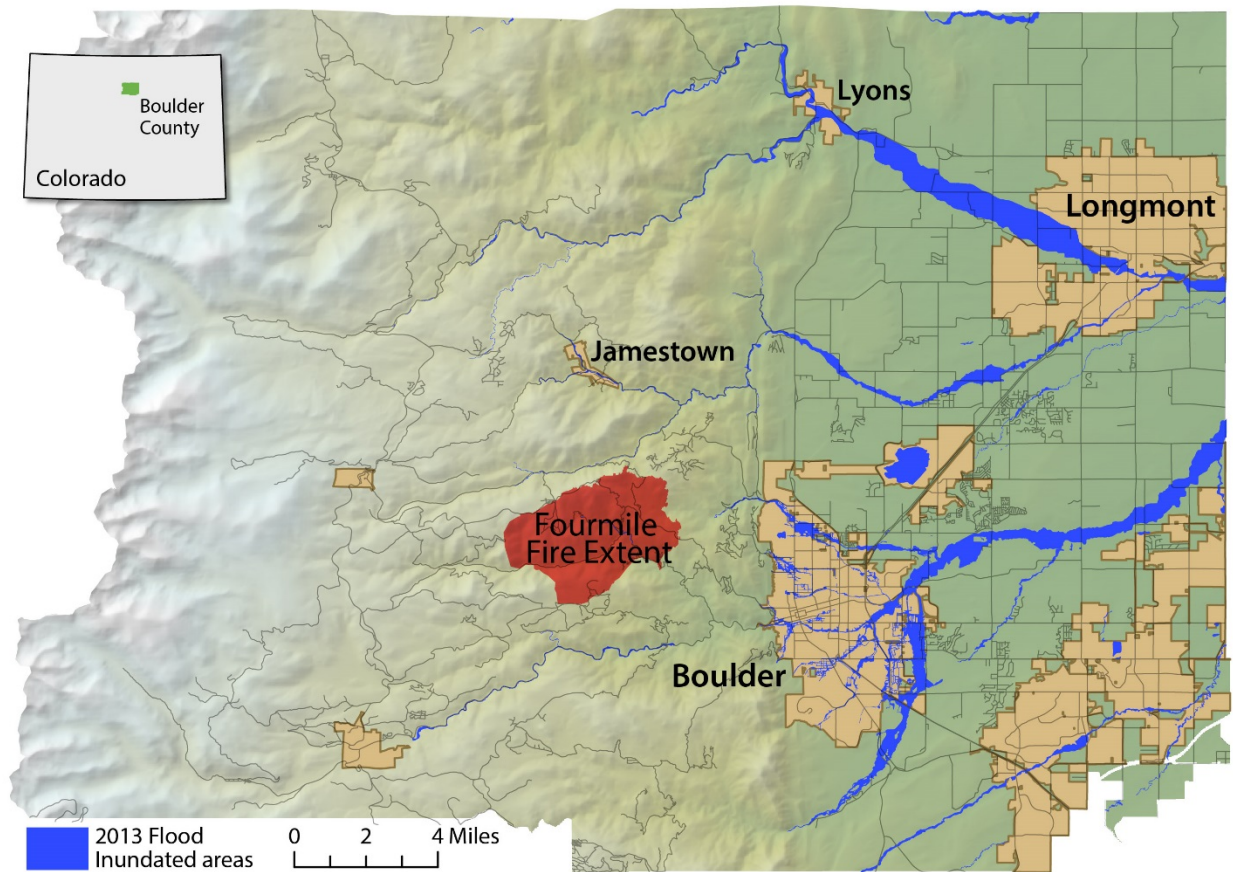
## Boulder County, Colorado

*“Five-hundred cubic feet per second is normal. A flood is 1,200 CFS. This flood came through at 36,000 CFS. It was like the Missouri River running through town.”*

*-John O’Brien; Lyons, CO*

In September 2013, several days of heavy rain occurred along the Front Range of Colorado, resulting in catastrophic floods. Among 17 affected counties in Colorado, Boulder County received the most rain. The city of Boulder received 17.5 inches of rain in just 8 days, which is a typical year’s worth of rain. The city received a total of 9 inches on September 12, 2013 alone, doubling the city’s previous 24-hour rainfall record of 4.8 inches. Despite the magnitude of the deluge, the City of Boulder’s prior preparations for flash flooding minimized infrastructure damage. Other areas of Boulder County had devastating damage. The flooding events led to four fatalities in Boulder County as a result of rushing floodwaters or mudslides. Boulder County encompasses all four locations included in the study – Longmont, Lyons, Jamestown, and the city of Boulder. See Appendix D: Areas in this study, for more information about these four locations.

Boulder County has a history of extreme weather events, including wildfires, droughts, and flash flooding, although 11 interviewees said that a flood of this type was unexpected or unprecedented. Another three interviewees said it was an expected result of the “new normal.” Notably, the Fourmile Canyon Fire of September 2010 burned for 11 days across 10 square miles, creating a known flood risk in the burn scar area. See Figure 1: Map, for a visualization of flood data from Boulder County and the City of Boulder. Flood data in other municipal areas was unavailable.



*Figure 1: Map (Source: Daniel M. Stephen, 2016) (Data: Boulder County Land Use 2016; Boulder County Land Use and US Forest Service 2016; Shepherd 2016; U.S. Geological Survey 2015).*

Because a culture of climate change concern was prevalent in Boulder County prior to impacts, there were city- and county-level efforts to mitigate climate change prior to the 2013 floods and the Fourmile Canyon Fire. Boulder County, according to its Web site, “is committed to addressing global climate change,” and works toward the Kyoto Protocol’s emission targets (Boulder County, CO 2016). In 2007, the City of Boulder became the first place in the United States to self-impose a carbon tax. After the flooding, efforts to gain local ownership of the corporate-owned electrical utility due to a desire for local control over reducing greenhouse gas emissions to combat climate change were accelerated and approved through a vote. Several reports and plans to reduce carbon emissions can be found on the

Boulder County Web site, including a Sustainable Energy Plan, a Greenhouse Gas Mitigation Report, and a Climate Change Preparedness Plan (Boulder County, CO 2016).

Boulder is home to internationally recognized climate research institutions. These include the University of Colorado Boulder; the National Center for Atmospheric Research (NCAR), which has a Climate Change Research Section; the Earth System Research Laboratory at the National Oceanic and Atmospheric Administration (NOAA); the Cooperative Institute for Research in Environmental Sciences (CIRES); the National Institute of Standards and Technology; and some of the world's most influential climate scientists. These institutions and scientists contribute their knowledge to the community. For example, NCAR has an educational center where visitors can learn about climate research, and NOAA offers weekly tours to the public ("National Laboratories" 2015). According to Matt Appelbaum, "A number of those [scientists] are active in the community, some active politically." Seven interviewees mentioned that research institutions are an influence on the local community.

### Climate Change Beliefs

I found that after the flooding events, people at the government, nonprofit, and community levels in Boulder County began to think more about climate resilience. The focus on climate resilience includes two components: 1) A long-standing community belief in climate change and awareness of climate change risks; 2) Increased focus on resilience-building, especially through the use of social capital. These are discussed in detail in the following sections.

### Climate Change Awareness

Prior to the flooding events in September 2013 or the Fourmile Canyon Fire, Boulder County residents actively discussed and took actions to mitigate climate change. Climate change was also a policy concern prior to impacts. County Commissioner Cindy Domenico said that within county government, climate change is, "...a recognized element in our future budgeting

processes.” State-level data shows that that in June of 2013, just a few months before the floods, 70% of Coloradans believed that climate change was occurring, and 59% were somewhat or very worried about climate change (Leiserowitz, Feinberg, et al. 2013), as compared to national data during the same time period, showing that just 63% of the U.S. population believed climate change was occurring and that 51% were somewhat or very worried about it (Leiserowitz, Maibach, et al. 2013). Follow-up research conducted in December 2013 revealed that in Boulder County, climate change attitudes were similar to the state, while the city of Boulder residents were even more likely to believe in climate change and to support climate action. This survey showed that only 1% of Boulder city residents did not believe in climate change (Talmey-Drake Research & Strategy, Inc. 2013). This data supports interviewees’ claims about local climate change beliefs. Also, in the year after the floods, there were 54 newspaper articles or letters to the editor that mentioned climate change. Of these 54 letters, 46 of them clearly indicated a belief in climate change, and three more strongly implied a belief in climate change. Three articles indicated climate change skepticism or denial, and two were unclear.

Of 19 interviewees who were asked about climate change, all indicated a personal belief in climate change. Thirteen people indicated a heightened awareness or sense of vulnerability after the flooding. Eleven of those 13 people indicated that it did not change their mind about climate change, but that the event made climate change feel more real or more salient. Eight interviewees indicated that perceptions of climate change did not shift as a result of flooding, and seven of these said that perceptions remained unchanged because awareness existed before the impacts. The following comment from former Boulder Mayor Matt Appelbaum demonstrates a heightened awareness of vulnerability without a change in beliefs:



This is not a place where climate change is in doubt in the slightest, and I don't think it was before the flood, either. It's an extremely well-educated, very scientific community and also a very liberal community.... I don't think there was anything to change before or after the flood.... There wasn't much to change. Having said that, I think people have a heightened awareness of it and the fact that although you can't really predict what climate change is going to do, there's just no question that the number of extreme weather events and the severity of them will almost certainly be increased.

Appelbaum provided a reason to explain the strong community beliefs in climate change:

"We're in a city that has all of these phenomenal research institutions – NCAR, NOAA, the University.

We really do have almost certainly more climate scientists than any place on the planet." Charlie

Brennan of the *Daily Camera* explained, "Because a lot of the scientists live here and they're your

neighbor... there's a cumulative perception in this community that climate change is real and climate

change is affecting the way that weather behaves." Thomas Wells of Boulder Flood Relief explained how

these climate scientists influence the community:

These people do participate in local government and politics, and they speak at city council events and are active members of the community, write in to the *Daily Camera*, and they talk to their neighbors.... Having that large body of three national labs in town, plus C.U., definitely changes things in Boulder.

### Risk Perception

Although beliefs in climate change were not altered, perceptions about the risk of climate change and vulnerability to climate change impacts did shift. As mentioned previously, 13 people who responded to the question about climate change indicated a heightened awareness of vulnerability after the flooding, and 11 of them said that after the flooding, climate change felt more personal, more salient, or "more real." Erika Archer, Flood Project Manager of Jamestown, said that after the flooding in Jamestown, "Most people, that was their first reaction – 'global warming at work.' That was the standard statement." Thomas Wells' view demonstrates an increased awareness of impacts:

Seeing the way that it impacted a lot of people changed my outlook on these kinds of events. I was already a climate change believer, if you will. I wasn't ever a denier, but I guess it kind of drove home the reality of how this affects people on a personal level.

Boulder County Commissioner Elise Jones also shows that the awareness of risks posed by climate change became more tangible and visceral:

We're already a community that is very aware of climate change...but then we had two major disasters of the nature of extreme weather events that are supposed to be exacerbated by a change of climate, and that further heightened people's awareness... People now have a real-world example or two of what a changing climate might mean to our community, the costs involved, the impacts."

Levels of risk perception were not universally distributed across the county. According to Tiernan Doyle of BoCo Strong and Boulder Flood Relief, "Each area in the county has changed differently as a result of the flood." She said that although the small mountain communities had spent years actively preparing for natural hazards due to their susceptibility to wildfires, urban areas were not as concerned about preparing. She said a particular challenge is, "Just trying to find ways to get people in urban areas where services are normally readily and easily available...to think more about preparedness, and it's difficult." Among urban people, "There's not as much perceived risk." Elise Jones agreed: "I think the folks who live in urban cores who were able to recover... there's probably less awareness of future flood risk there." Doyle also said that climate change discussion occurs, "more at the policy level and some in the city of Boulder among the folks that were less hard hit," because, "they're not so focused on their own recovery process." These statements support the idea that despite heightened awareness of climate change risks, actions were oriented toward recovery and preparation. They also raise the possibility that different types of actions occurred among different groups, depending on the level of personal impacts. This corresponds with the idea that risk perception may be affected by the level of personal impacts. It also seems that there could be an urban-rural divide due to the greater likelihood of wildfires and floods in rural areas. Charlie Brennan explained this second possibility: "Between fire and flood, the people up there have every reason to live in a very sort of cautious posture."

Although there was a greater awareness of risks posed by climate change, risk perception was not always directly connected to climate change awareness. Of the 13 interviewees who indicated a heightened awareness or vulnerability after the flooding, two did not indicate that climate change felt more real or more salient, but did discuss the role of trauma. One person, when asked if people are more aware of future risks, said, “Yes, absolutely. We have a community that was quite traumatized. If it rains for more than a few hours, you can just feel the tension and the mood shift.” Another said that Post-Traumatic Stress Disorder caused some people to worry every time it rained. A third person spoke at length about many hazard mitigation measures taken to reduce vulnerability after the floods. When asked about climate change, the individual said, “People wonder whether it’s connected to climate change.” Perhaps these examples show that the traumatic experience can increase risk perception, but that climate change does not necessarily evoke the same visceral response, even among those who believe in climate change. As such, I have been mindful of when to attribute risk perception to climate change awareness. However, it seems noteworthy that 11 out of 13 did make that connection.

### Building Climate Resilience

The second major component of my findings is that there was an increased focus on resilience-building, especially through the use of social capital. People began to think more about climate change risks, which was reflected in their actions. The extreme weather events seemed to cultivate a focus on resilience as a way to take action to address the risks associated with climate change. The first section below discusses climate change action. The second section discusses how climate change action was translated into resilience-building.

### Climate Change Action

The following statements show that the event highlighted the need for action. Actions mostly involved recovery and adaptation, while mitigation was less urgent. According to Tiernan Doyle,

“Inaction is not an option, and our past wildfire and flood events helped make that more compelling for people to understand.” Micah Parkin, Executive Director of 350 Colorado said, “We are being impacted by climate change.... Even if we stopped emitting all the carbon and the methane today... we’re going to have a lot more of these sorts of impacts.”

In Longmont, a primary concern was disaster recovery. When asked whether community members had expressed concerns about climate change to city planners, Dan Eamon, Longmont Emergency Manager, said that citizens were most concerned with the impacts that affected their day-to-day lives, such as a bridge that was still undergoing reconstruction 2 ½ years after the event. He said, “People are still more focused on what’s real to them today.... We hear more about [the bridge] than we do about the climate change discussion.” Regarding the topic of climate change, “We don’t really get into it, probably because we’re still in the deep actual physical rebuilding.” However, in rebuilding, Brad Schol, Longmont Special Projects Manager, expressed the need for government to adapt to the “new normal” – new weather patterns – in the planning and rebuilding process. This shows that adaptation for the future is a consideration for the City of Longmont even though recovery is the primary issue.

Outside of Longmont, there was also a sense of a need for action that addresses future impacts.

Boulder County Emergency Manager Mike Chard said of the climate change debate:

I think we should be prepared for more and more severe. That sort of message seems to stick with both sides of the aisle politically, and it’s important for emergency management to be apolitical in that debate and really try to encourage the community preparedness, resiliency, sustainability work that needs to go on and not get caught up in the argument.

This statement expresses the notion that when it comes to climate change action, the important thing is to prepare for impacts. Tiernan Doyle also talked about BoCo Strong’s focus on actions rather than discussions about climate change. She said that despite the community’s “uptick in interest in talking about climate change,” “We [at BoCo Strong] haven’t found it to be necessarily productive in

engaging with the community. It's just not the focus. It's more of a part of the overall picture." Doyle explained:

We're trying to make resilience more tangible to people.... It's really these community actions we're talking about, and I think what, a lot of times, the climate change piece gets translated down to. These policymakers in Boulder County, we're always talking about it at some level, but from the community perspective, it's more about those actions.

These quotes convey a perception among community leaders that taking action to address climate impacts is important. Boulder County Flood Recovery Manager Garry Sanfaçon explained the importance of actions that address future impacts. This statement also shows how the concept of climate change is translated into discussions about actions that build climate resilience:

We need to shift and start adapting to what's coming, and these two events have really helped bring that home.... We have a group called BoCo Strong, which is a resilience initiative that's comprised of all the impacted cities and other organizations, to try to build a culture of resilience throughout the county.... More focus is around the social resilience piece of things – connections to people, relationships, and resources.

When it comes to climate change action, it seems that community leaders were most concerned about addressing impacts and adapting. However, there was some discussion about climate change mitigation. The following quote from County Commissioner Cindy Domenico shows that even though adaptation became more important, mitigation still remained a concern after the floods:

I have been convinced for many years that [climate change] is happening...it's always been a concern, but then to see the kinds of events that we've been having with both fire and flood, you know it's real. It's changed my awareness and changed some of my strategies and behaviors. In the county, we definitely talk about it all the time. Electric cars -- what can we do about our fleet? What can we do about anything where we can make even a small difference? We're working on it and looking at sustainability as a practice, and have been for a number of years.

In Jamestown, Erika Archer said that after the flooding, she saw a move towards environmentally sustainable practices that offer multiple benefits, including personal and household resilience, as well as mitigation. She said in Jamestown, "I've seen people move toward more

sustainable practices. I've seen solar installed," and "I've seen more people start to keep chickens, bees, things like that... not just because of the just-in-case scenario, but it's more healthy, and you help your environment with the bees." As demonstrated in the above quotes, extreme weather events and an awareness of climate change led to an increased awareness of risks and a focus on building climate resilience. It is, as Doyle suggested, a way to make climate change actionable.

## Resilience

Sixteen interviewees mentioned "resilience," often in response to the question about climate change. According to Elise Jones, "Everybody's talking about resiliency now. Nobody was talking about resiliency three, four years ago." Nine interviewees said that the increased concern about resilience occurred after the flooding, and one said that it happened after the Fourmile Canyon Fire. Matt Appelbaum said the focus on resilience is due to two factors: "Both because of the event and because of the honor of being chosen by the Rockefeller Foundation, we are focusing a lot more on resilience in general," but also said about the funding, "I think we would have put more emphasis on resilience anyway, but this really focused us, and it really put it front and center." John O'Brien, former Mayor of Lyons, also said that funding played a large role in the focus on building resilience.

Experiencing a previous extreme weather event provided lessons that were used to build resilience. Cindy Domenico shows that in the following statements: "We took our experience from Fourmile [Fire] and applied it to trying to be prepared as best we could," and, "It seems like about every four years we have something happen. We kind of get in a mindset that we do need to be prepared." The outreach, education, networking, and preparedness that occurred prior to the flooding empowered people to take action effectively, according to Tiernan Doyle, who said, "There were lives saved by those connections and that preparedness that they had in place."

Resilience can mean different things to different people. In Boulder County, when people talked about resilience, social resilience was the most common theme – even more common than physical resilience, which involves rebuilding and strengthening infrastructure to withstand impacts. When people discussed threats to social resilience, they mentioned displacement, homelessness, lack of financial resources, lack of affordable housing, impacts to vulnerable populations during disasters, poverty, and isolation. When talking about how to build social resilience, people talked about helping others, building social connections, preserving the connections and relationships that formed after a disaster, building social capital through connections between neighbors and through community networks, addressing social issues collectively as a community, and responding to disaster as a community. From a policy perspective, it involved working on affordable housing, integrating resilience plans across county departments; improving community engagement, outreach, and education; cultivating community leaders, and “creating a culture of resilience.” These responses, for the most part, indicate that in Boulder County, social capital was regarded as integral to building resilience. Elise Jones demonstrated the perceived role of social capital in building resilience:

[It] includes looking at long-term chronic vulnerabilities, like poverty, and for mountain towns, isolation. As we work on resiliency, we’re having conversations that we hadn’t had before about cultivating community leaders and community networks that can be activated when events like this occur. That was not a conversation we were having before.

Although resilience efforts in Boulder County involved preparing for a variety of threats, the scope of this paper is limited to climate resilience efforts. Climate resilience themes included physical resilience, ecological resilience, and social resilience. These three aspects of resilience were important and showed up as themes in my data analysis, but I focus on the social aspect of resilience in this paper because it was the most commonly discussed among the opinion leaders whom I interviewed.

## Social Resilience

In Boulder County, social capital was frequently seen as an element of resilience. Interviewees reported positive benefits associated with social capital. Not only did people help each other, but there was a surge in cooperation, formation of grassroots groups, and policy changes that took place more easily due to public cooperation. In order to build social resilience, interviewees felt that it was important to build social capital at the neighbor-to-neighbor level, through grassroots groups, and by building cooperation and trust between citizens and local government, grassroots groups, and nonprofit groups. The claim that social capital was treated as a tool for building resilience is based on interviews and newspaper articles, as well as the groups that formed in response to extreme weather events, and Web sites and documents, including research done by BoCo Strong during community meetings in 2014.

Several groups formed in the wake of the extreme weather events (See Table 1: Groups). The groups included in Table 1 were oriented towards social resilience in some way. This is not an exhaustive list of groups that formed, but it demonstrates interest in collective action, social capital, and social resilience. Aldrich (2012) actually goes a step further and uses the number of nonprofit groups created in the wake of an extreme weather event as a proxy to measure levels of social capital.



*Table 2: Groups that formed in response to extreme weather events*

<b>Group name</b>	<b>Type of Group</b>	<b>Primary areas of focus</b>	<b>Formed after flood</b>	<b>Formed after fire</b>
Long-Term Flood Recovery Group (LTFRG)	"A collaborative team of community leaders, local and state officials, representatives from affected communities, FEMA, non-profits and others who manage the Foothills Flood Relief Fund" (Source: bocofloodrecovery.org/)	Primarily financial assistance, but also housing, resource allocation, serving as a link between volunteers and those in need, and "creating a sense of community resiliency and engagement." (Source: bocofloodrecovery.org)	X	
BoCo Strong	Countywide resilience coalition supported by LTFRG, Boulder County, Lyons, Jamestown, Longmont, businesses and nonprofit groups	"To create and support collaborative relationships between individuals, communities, nonprofits, governments and businesses" (source: bocostrong.org). Increase resilience through community engagement, public education, leadership training, and through the sharing of information, knowledge, and other resources	X	
Resilient Boulder	Local chapter of Rockefeller Foundation 100 Resilient Cities Initiative	Building resilience to a variety of impacts through networking and citizen engagement	X	
Watershed coalitions	Collaboration of several watershed groups	stream restoration and floodplain management, community shared learning, public engagement, collaborating with landowners and residents to build ecological resilience	X	
Intermountain Alliance	Collaborative network of citizens and government entities	Community shared learning, building resilience, supporting collaboration between government and citizens		X
Boulder Flood Relief	Grassroots Group	Providing immediate relief; raising awareness of need for grassroots groups to work with larger organizations	X	
Mudslingers	Grassroots Group	Provided immediate relief through word of mouth, social media, and community outreach	X	

In addition to these groups, a cooperative climate adaptation plan and intergovernmental agreements between state and county governments and federal agencies such as the US Forest Service played a role, as well as mutual aid agreements between emergency response departments and fire departments. Also, in the immediate aftermath, municipalities cooperated with the county, non-profit organizations, and businesses to provide flood relief. In other words, Boulder County's high level of cooperation was strengthened after these events.

According to Cindy Domenico, many of the intergovernmental agreements emerged in response to the Fourmile Canyon Fire, and they were beneficial during the floods. She said, “Building on the fire experiences, we leaned on all those agreements to provide services to citizens across the board.” This shows that the relationships that formed in response to one event helped with building resilience to another event, and that networking played a large role in building resilience.

Although social capital was seen as a way to build resilience, it should not be uncritically assumed that social capital leads to resilience. Social capital, while offering a “foundation for resilience and recovery” (Aldrich 2012, p. viii) has a complex way of functioning in the community post-disaster, much of which is poorly understood in the literature, especially in relation to climate resilience. Some of these complexities showed up in this case study of Boulder County, and I discuss them in the following section. This section draws on social capital theory to explore several social situations that occurred in a post-disaster context and their implications for climate resilience. Factors that I discuss in the following sections include access to resources, division and marginalization, community empowerment, and relationships between government and citizens (linking social capital).

### Bonding Social Capital: Access to Resources

Interviewees indicated that community-level social capital increased during the immediate aftermath of the flooding in the form of neighbors helping their neighbors, which provided people with resources they needed to survive after the event. Susan Becker, who curated a collection of oral histories about the flooding for the Boulder Public Library, said, “One of the things that came up over and over and over again is people talked about a sense of community – that they felt, through these events, a much more heightened sense of community and people helping each other.” According to Erika Archer, in Jamestown, “People have stepped up their game as far as organization and planning and wanting to be a part and take that responsibility of what it means to be a community member.” When

asked about the value of social capital in Jamestown after the flooding, she replied that social networks provided individuals with resources that allowed people to survive. She said, “It goes back to that buzzword which everyone likes to use right now, which we just kind of call ‘resilience.’” She explained, “Community mattered and the networking in the community mattered, and that’s where people were able to access resources that they may not have had otherwise.” These community resources were even more beneficial than monetary resources, according to Archer, who said, “People without money were certainly at the highest risk, but I’ve also seen people without money thrive the most, so I think... social people thrived the most.” These statements show a perception that during and after the event, social connections granted access to the types of resources that allowed people to survive.

Mike Chard, Director of the Boulder Office of Emergency Management, also expressed the idea that those with the most social capital are the most resilient:

I’ve got these simple questions I ask folks. “Are you a resilient person? Do you help your neighbors? Are you connected to your neighbors? Do you know not just your neighbor, but the ones three blocks over? Are you the guy or the gal that actually goes out and helps someone take their groceries in, or...the senior citizen that’s barely struggling to hang on in their house because they’re aging and lost some abilities – are you the one that goes over and organizes painting their house?” Those are the people that, if they’re in your neighborhood and that’s your neighborhood, that’s resiliency. If that stuff happens in regular time, I guarantee it’s gonna happen in disaster, and for those that normally have it, disaster will bring it out in you. But for those that live it, they’re just gonna basically just take care of it and roll with it. That’s the resiliency piece.

He summarized, “Who you have around you is who’s gonna save you.” While there is some emphasis in the above statements on levels of social capital that existed prior to flooding, there is an implication that people also became more social in response to the flooding event. This was particularly true in the first year after the event. According to Aly Nicklas, organizer of the grassroots group Mudslingers, “Right after the flood, people were like, ‘I talked to my neighbor for the first time ever.’” Brad Schol said community bonding in Longmont increased

right after the flood, which was evidenced by, “residents organizing themselves after the flood and having a lot of community meetings.” Chard said, “During that first year after the disaster, you get a real heavy desire for the community to want to meet, have that engagement... The second year, it drops off dramatically.” Victoria Simonsen, Lyons Town Administrator, said that she saw more social engagement in the community “for about the first year” after the flood. Erika Archer said that community engagement occurs because, “Right after a disaster, everyone wants to help.” And according to Thomas Wells, referring to the large number of volunteers in the days and weeks after the flood, “The excitement and the energy around the flood really dies down very quickly.” These statements show that throughout Boulder County, the community became most engaged and most socially connected right after the flooding.

After the flooding, there was such an overwhelming response from the community that individuals who reached out to assist organizations like the United Way and Red Cross immediately after the event were often turned away. According to Cindy Domenico, “Everywhere we looked, there were citizens interested...to help those that were affected. The coordination of that effort is really challenging in the moment. People just want to help. And then how do you coordinate the effort? It’s a challenge.” The grassroots groups Boulder Flood Relief and Mudslingers formed in response to that need, providing volunteers a way to help people in their community. Although this is an example of increased bonding social capital, it also shows how institutional context interacted with bonding and bridging social capital.

Thomas Wells said that one of these grassroots groups, Boulder Flood Relief, filled a niche by providing a way for people to volunteer. He said, “They wanted to volunteer, and they weren’t being given opportunities to volunteer, and our organization and Mudslingers ended up filling that need.” According to Aly Nicklas of Mudslingers, “There’s something that we can do as citizens that larger organizations can’t, and that was the coolest part about what we did.” According to Wells, “We were

quite interested in trying to help the more established organizations, the official groups, figure out how to best interact with us.” He said:

In the future, as these sorts of events occur, you’re going to have, because of social media, more and more instances of these sort of pop-up grassroots organizations, and we wanted to try to help them figure out how to interface with that.... That’s been a little bit of our focus – both communicating our lessons learned and also trying to help these organizations figure out how to work with the pop-up groups.

These grassroots groups filled an important role by giving volunteers an outlet to provide their community with the aid it needed. It filled a niche that more organized groups were unable to fill and provided the community with access to resources through the engagement of local citizens, thus fostering resilience in the community.

### Bridging Social Capital: Division and Marginalization

The town of Lyons had strong social capital in place, but it did not protect the town from becoming divided and having marginalized groups in the long run. Victoria Simonsen, Lyons Town Administrator, said that even before the flooding, “Lyons was a very close-knit community,” and that these bonds continued to be strong after the flooding: “For the first year afterward, it was very harmonious.” She said that after the flooding:

We held weekly community-wide meetings. We would sometimes have like 600 people there. It was amazing. People from the state and federal government were like, “We have never seen this,” and we said, “We are neighbors. We’re family. We all are intertwined.”

Both Simonsen and former Mayor of Lyons John O’Brien explained that citizens rallied together to develop a recovery action plan after the flooding. O’Brien said of the effort, “We did a year’s worth of planning in eight weeks, and it was a really great effort. People really felt part of the whole and just were really motivated.” Tiernan Doyle of BoCo Strong said:

People in Lyons, they had really good connections to nonprofits, to their community foundation, and to other organizations, so they’re a very well-networked town, and

their networks are not just local... They were devastated by the flood, but those networks allowed them to access a lot more resources than other areas.

She also added, "Those local relationships can be both a benefit and a negative when people start to get too insular." Simonsen said that although people were united for the first year, those bonds did not last: "That whole first year was really quite amazing, but since then, our community has felt really fractured."

Simonsen, Domenico, and O'Brien explained that the town of Lyons became divided over whether to create affordable housing in open space to replace affordable housing that was destroyed, but ultimately voted to keep their open space. O'Brien explained, "It was a really good example of 'Not In My Back Yard.' That really divided the town." According to Charlie Brennan, "The people who remain in Lyons are people who were in nicer houses." Domenico explained why low-income people were the most affected: "One of the most difficult challenges of disasters like this, low-lying areas are highly impacted, and low-lying areas are oftentimes where our lower income families wind up living." She explained that the proposed housing development was well-funded and would have created affordable housing for displaced residents, if not for the barriers that could not be overcome:

The Lyons community has really struggled with how and where affordable housing should occur in that town now.... The town actually decided not to move forward with the project that would have made a difference. It would have helped. You have to have the full political will of a community to do that.

O'Brien's explanation may explain the lack of full political will: "There were a lot of reasons why people voted against it.... It was usually couched in terms of, 'Oh, yeah, sure, we value diversity, but put them over there, not here, not next to me.'" According to Simonsen, "It is the first time any of us remember our community being so divided over the housing issue." She described a social division that occurred after the first year: "Half of the community had moved on and were like, 'Time to get over this flood,' and for the rest of us still dealing with it... we are still far from over it." She added, "Socially, we

are in different places.” In other words, although Lyons had strong social capital and a realistic way to move forward, along with funding, the community was socially divided. Even in the town of Lyons, where social capital surged after the flooding, social capital did not necessarily lead to resilience. The quotes seem to indicate that bonding social capital increased while bridging social capital was weaker, especially regarding low-income residents, as evidenced by the comments about “Not In My Backyard,” insular relationships, diversity, and income. The descriptions of Lyons as “divided” and lacking the “full political will” of the community show that a lack of bridging social capital may have been a problem.

Affordable housing is an important issue for Lyons, according to O’Brien. He said, “One of the results of not having enough affordable housing is that we don’t have the workforce housing.” He explained that, as a town that relies on the tourism industry, it is important to have housing that is affordable for service-industry employees. He explained, “We have a lot of restaurants in town, and every single one of them is trying to get employees and finding it very, very difficult.” Simonsen said of the people who were displaced:

Much of our employment base is waiters and waitresses for restaurants and bartenders and musicians. I think they started realizing they couldn’t afford to make that trip to Lyons for a minimum-wage job. Employers started losing their work base, and people started giving up hope that there would be replacement housing.

O’Brien also described a loss of the essential character of Lyons. He said, “It is known as an arts and music town.” He explained that Lyons is a center for music festivals, but the musicians are not necessarily the wealthiest individuals in Lyons. “We have some Grammy Award winners here who make \$30,000 a year... some of those people simply cannot afford to live in Lyons anymore, and it’s a big loss for the town.” As a result of the displacement, he said, “There is a different kind of culture.”

In this case, social capital surged after the flooding and provided resources to people. This could make it easy to believe that social capital is universally beneficial, but when looking at the long-term

outcomes in Lyons, a place where there was strong social capital, it is evident that divisions can still occur and social marginalization can still cause major changes. In this case, it resulted in a loss of the employment base for the tourism industry and a hit to the arts and music scene.

### Linking Social Capital: Empowering Communities

Mike Chard, Director of the Boulder County Office of Emergency Management, provided a personal story about linking social capital, in which he worked with rural communities on emergency preparation. He discovered during this work that his approach to outreach affected public responses, and he discovered that he could empower people through education about preparation and resilience. He found that when he simply conveyed facts about the risks, people felt fearful and powerless about the reality of the risks, and they shut down. But when people felt empowered with knowledge of what to do about the risk, they felt prepared and confident to take action. The second approach, according to Chard, is a more empowering approach. This sentiment about the importance of education and empowerment was stated by others too. Dan Eamon, Longmont Emergency Manager, said that one of the main components of resilience is, “educating my community on how to prepare itself, ‘cause that, by far, is the biggest resource we have.” He also said, “We have to learn how to educate our community to be resilient so that it can take care of itself.” He emphasized the role of community meetings as, “a vehicle to engage the public,” to educate them. Joel Wagner, Boulder Flood Recovery Coordinator, discussed educating the public in Boulder through a home resilience audit program designed to, “educate residents about what they can do to their own properties to make them more resilient in flooding.” Chris Meschuk, Boulder Flood Recovery Coordinator, said that after the flooding, the City of Boulder, “did a massive amount of outreach with residents” about flood education, and then began the home resilience audits to educate homeowners. He explained, “They do energy audits for people. Let’s do resilience audits of how do you protect your home from natural disaster risks.” According to Dan



Eamon, after the flooding in Longmont, the public was eager for education. He said, “The biggest response we got... was a desire to know where to go to find information...and the desire to know how to meaningfully engage so that they don’t feel isolated.” These quotes show the value of community outreach, education, and empowerment in disaster preparedness.

Chard indicated that while the relationship between government and citizens is essential, the purpose should be to empower citizens and communities. When educating people and communities about disaster preparedness, he said it is important to build relationships:

If you’re gonna be building these resiliency programs and you’re gonna be a governmental rep, you’ve got to be *with* the folks, so there’s a lot of nights and weekends I did with these folks and really got to know them, became their adopted son in many of these communities and really learned a lot. I learned more from them than they learned from me.

This approach helped him to understand the needs of the community, as well as their capacities. He said, “I learned about who these people were and what their capabilities were and what their desires are and needs, and they taught me a lot about the community culture and make-up.” This supportive, “horizontal” approach to introducing a resiliency program in a rural community allowed him to work with them and empower them to take action to prepare for future events, using their own resources to create emergency plans that served as examples to other communities, resulting in communities that are “the ultimate picture of resiliency.” This narrative shows an instance when positive relationships between government and citizens broke down barriers and equipped citizens with information that empowered them to participate in their own risk management and generate ideas that are locally and culturally appropriate.

From an emergency management perspective, the use of linking social capital in risk management resulted in greater resiliency. Mike Chard says that the lessons learned from the Fourmile

Canyon Fire were shared among the community, and collaboration with other experts and local communities led to a “razor-sharp” emergency protocol that ultimately saved many lives:

It’s remarkable to think one disaster led to the successful management of another. That’s how it’s supposed to work. We call it community shared learning. That’s what it’s about – you’ve got to share everything you learn and everything you build with everybody you can, and get it out there as broadly, as far as you can, and we want our residents to know what we know.... If you have something that’s important to know, find a way to share it.

He added, “We’re big sharers. We share with the state, we share with counties, we share with cities. We shared with Thailand. We’ve been going all over the country doing lectures on flood preparedness and response.” He also said, “Our partnerships have broadened ‘cause we’re meeting people we wouldn’t have met before, and we’re in a good spot from that.” In this case, a government representative built linking social capital between himself and the rural communities he worked with. This linking social capital enabled the use of community shared learning to empower communities to build resilience.

### Loss of Linking Social Capital

After the floods, the small mountain towns of Lyons and Jamestown both experienced a transformation of their governance structures and levels of public input due to federal recovery funding requirements. Interviewees who spoke about Lyons and Jamestown indicated that prior to the flooding events, citizens had close relationships with their local government and that these town governments valued their autonomy, independence, and ability to respond to citizens. Interviewees indicated that post-flood disaster funding requirements and policies eroded that autonomy. This new dynamic affected relationships between local government and citizens. Millissa Berry, Town Planner for Jamestown, said that before the flood, “If something needed to be done, it got done by someone stepping up and doing that.” But as a result of the changes after the flood, “A lot of the projects and decisions that people were used to participating in became something that was out of their hands, so that was a little bit disturbing

for some community members here.” Victoria Simonsen expressed a similar issue in Lyons. She said, “Prior to the flood...someone could ask for something directly to me, and I could just take care of it.”

After the flooding, that changed:

People were used to just being able to call me or walk in my office anytime, and now they have to make an appointment.... I think people aren't as trustful because we would say things like, “We have a goal to do a project in this timeframe,” but...you don't know at that point all the bureaucracy involved and all the red tape of getting state and federal funding, and so they feel like you're not keeping your word.

This loss of trust and reciprocity between citizens and local government indicates a loss of linking social capital. Despite the importance of linking social capital, which was emphasized by Mike Chard, the “bureaucracy” and “red tape” surrounding disaster funding had the unintended consequence of eroding linking social capital, which might undermine Boulder County's efforts to use social capital to build resilience. Simonsen's quote exemplifies this problem:

Last night at our board meeting, people were coming in and saying, “Can't we just get together some local guys and just grade and do this work?” And it's like, “You can't do that. You have to have it all approved before.”

This statement shows a situation where the loss of linking social capital was disempowering to citizens, which undermined citizens' efforts to engage in their community and to build resilience. In this case, federal requirements for disaster assistance disrupted the linking social capital between local government and citizens.

## DISCUSSION

This section summarizes my interpretations of the data, which I put forth in the Findings and Analysis section, and then makes meaning of the interpretations and the broad findings in relation to each other. It also discusses areas for future research and limitations of this study.

My Findings and Analysis section showed that after the flooding event of September 2013, there was a greater awareness of risks posed by climate change, accompanied by a greater focus on building

resilience, especially through the use of social capital. As discussed, Boulder County already had a culture of climate change awareness and action. Although people agreed that climate change action was important, actions after the flood tended to focus on building resilience. There are a few important key interpretations of my findings. First, levels of personal impacts likely affected different groups in different ways. Also, risk perception, climate change awareness, and climate change action were not necessarily connected to each other in an intuitive way. My findings correspond with existing studies showing that risk perception is affected by the level of personal impacts, and that knowledge, beliefs, or the experience of an extreme weather event does not necessarily lead to climate change awareness or action (Albright and Crow 2015; Wachinger et al. 2013). Boulder's high levels of education and affluence may limit the generalizability of my findings to other different contexts. However, even if this is the case, my findings can still provide important theoretical implications.

An important implication of my findings is that as climate change impacts occur, people may not respond by mitigating climate change, but may instead direct their attention towards the risk of future impacts. Based on this information, from a policy or planning perspective, it might not be productive to educate people about climate change or convince people that climate change is real. One recommendation would be to focus instead on local risks (Brenkert-Smith et al. 2015). The literature and my results both support the idea that focusing on building climate adaptation and resilience would be more productive than focusing on climate change education and mitigation. It is especially important to note that evidence suggests knowledge and risk perception are not strong predictors of action, so public education measures should go beyond increasing awareness of risks. People are much more likely to take action when they feel that they are *able* to take action and when they feel that their actions will be effective (Bubeck et al. 2012). Education and outreach efforts utilizing linking social capital can help to enable these empowering conditions to occur (Marín et al. 2015; Satterthwaite 2013).

A survey conducted in December 2013 of Boulder County climate change attitudes indicates that 32% of rural residents strongly agreed or somewhat agreed with the statement, “I resent local government trying to get me to do things so they can meet their environmental goals.” The report points out that this finding could help to explain a lack of engagement in climate change action (Talmey-Drake Research & Strategy, Inc. 2013). However, my findings showed that when local government used a horizontal, engaging approach to interacting with rural people, they were receptive. This finding further supports the idea that it may be best to focus on adaptation instead of mitigation, and to do so in a way that empowers local communities and vulnerable or marginalized groups.

In post-flood Boulder County, climate change actions were geared toward building climate resilience. The climate resilience model in Boulder County goes beyond mitigation measures such as sustainable practices and reduction of greenhouse gases; it also incorporates recovery and adaptation measures such as preparation for more frequent and more severe impacts. There is also a recognized need for a resilience model that, “embraces human and natural systems as complex systems continually adapting through cycles of change” (Walker 2006). The shift to resilience in Boulder County represents a recognition that although we can still take actions to combat climate change, the environment is now changing. The previous sustainability and greenhouse-gas reducing efforts still exist in Boulder County, but resilience includes looking at the bigger picture, seeing the interconnectedness of systems, and preparing for a future of changes (Walker 2006).

My findings also show that there was a window of opportunity after the event, during which communities were more socially active and engaged. After the event, there were several policy changes that were approved by voters, including tax increases and local ownership of the electrical utility, which gained momentum after the floods. Additionally, the number of community meetings increased, and there were record numbers of community members in attendance at these meetings. Communities

dealing with disaster recovery should try to take advantage of this window of opportunity to make changes. Changes that occur during this window of opportunity should consider how policy affects social capital and work towards empowering communities through linking social capital (Marín et al. 2015).

Another important finding is that social capital was not necessarily a universal panacea. The four sections under Social Resilience show different scenarios regarding the relationship between social capital and resilience. In the first case, social capital was shown as a benefit – neighbors helped their neighbors, providing access to resources and helping to increase resilience (according to interviewees). In the second case, we see that Lyons did experience this level of social capital at first, but over time, they ultimately became more divided. This is possibly due to a lack of bridging social capital, which is “critical to both economic opportunity and social cohesion” (Narayan-Parker 1999). There could also be a temporal factor that affects social capital over time after a disaster (Marín et al. 2015), or perhaps geographic changes that happen during a disaster can affect social capital, or a variety of other factors. Eventually, low-income groups were marginalized and displaced, resulting in a lack of work force and a loss of the arts culture, according to interview data. Impacts that affect vulnerable groups and affect the overall composition of the community indicate an inability to adapt and a lack of resilience (Adger 2000; Sapirstein 2006; Satterthwaite 2013). In the third case, an emergency manager built social capital among his department and rural communities, using personal relationships, mutual education, local resources, and local context to build resilient communities. The fourth case shows a situation where federal policy disrupted the relationship between local government and citizens, undermining resilience. These last two situations correspond with the literature that says institutional factors, such as policy, can affect social capital (Marín et al. 2015). These examples show that there are a multitude of context-specific factors that can affect the connection between social capital and resilience. The policy implication is that when looking at how to build resilience, social capital should not be treated as a cure-all. Instead, it is

important to consider how different types of social capital function in the community, conditions that could affect social capital, and how the needs of the community are affected by local context, social dynamics, culture, time, and geographic changes that occur during and after a disaster.

The surge of community engagement after a disaster could create opportunities for encouraging climate change action by expanding opportunities for participation. Marginalized and vulnerable groups are most likely to be affected by climate change, so they may have different perspectives on the issue. According to Parr (2012), "It matters who claims ownership of the discourse and politics surrounding environmental and climatic change." These groups could add new perspectives that socially and politically powerful groups might not consider on their own (Ferragina and Arrigoni 2016; Parr 2012). Therefore, I suggest that local governments dealing with disaster recovery take advantage of that window of opportunity while it is available to them and embrace the surge in community engagement.

Policy requirements set by state and federal governments are often universal across many different contexts because it is the most efficient way to do things. However, my findings show that local context is important. State and federal policies should be assessed before and after implementation to determine whether they are effective based on locally appropriate standards. Policies could be assessed efficiently by developing sets of indicators that are typical of certain types of contexts, such as coastal towns of a certain size or rural mountain areas, and then using those common indicators to measure policy effectiveness for each type of setting.

### Areas for future research

Future research should take a closer look at the link between social capital and resilience. I did not have an opportunity to explore this particular connection in the depth that it deserves. Studies should include a variety of variables when looking at the connection between social capital and resilience, taking local context into account. It should consider that it is a dynamic, rather than linear

relationship, which changes over time. A smaller unit of analysis, at the community level as opposed to county level, would allow a greater focus on local contextual factors. Longitudinal and quantitative data may help to clarify the nature of the relationship between social capital and resilience, which cannot be determined by a case study that relies primarily on interview data. I also recommend using qualitative methods to analyze how communities think of resilience. I found that people talked about different types of resilience and different ways that resilience could be built. An effort to understand the connection between social capital and resilience would benefit from a more concrete definition and the application of existing resilience theories.

Bostrom (2002) argues that addressing global, existential risks such as climate change requires a unique approach utilizing prediction, which requires calculating the probability of specific risks so that we can develop customized ways to target those risks. However, prediction is inherently difficult, and it is particularly difficult to ensure accuracy in the fields of climate change and environmental justice (Checker 2007; Wachinger et al. 2013; York and Clark 2007). My data analysis showed that co-benefits were often valued during planning in Boulder County, although this area of research was beyond the scope of this study. At the institutional level, a broad approach to planning for many potential outcomes, by using multi-faceted and holistic approaches that maximize co-benefits, as seen in my data analysis from Boulder County, may be a tool that communities use to deal with uncertainty. IPCC says that there is a need for research regarding “assessment of the health co-benefits of alternative climate mitigation policies” (Ch. 11 p. 741), and Boulder County is a potential case study for this type of research. This co-benefit strategy of building resilience would be interesting to study through the lens of resilience theories that look at the connection between physical, social, and ecological resilience.



## Limitations

One limitation of this study is that the interviews occurred 2 ½ years after the event, which could reduce the details that interviewees recalled, although it could offer a more comprehensive perspective of the experience. Another limitation is that my interview data was not longitudinal. In order to address this limitation, I used government documents produced before the flood to review policy actions, social issues, and environmental issues that were being discussed during that time.

My findings are based on opinion leader perspectives, obtained through a purposive sampling method. Including secondary interviews and research conducted by BoCo Strong during community meetings allowed me to compare opinion leader perspectives with other perspectives. An area for future research would be to reach out to people who were marginalized or displaced by this event to understand their perspective as well.

Although social capital is intuitively linked to certain social outcomes (Woolcock 2001), there is dispute as to whether causation can possibly be claimed, specifically in the context of resilience (Adger 2003). As such, I have focused empirically on how opinion leaders understood the role of social capital, but I do not attribute outcomes directly to social capital. My goal was to use the lens of a common framework to provide a more nuanced and complex analysis of social capital's role in the community response. This type of analysis may be beneficial to developing the theories of collective climate change action and climate resilience, specifically in a post-disaster context. There may be useful implications for theory and for similar contexts (Tsang 2014).

The finding that people talked more about social resilience than physical resilience, especially in Boulder, could have been due to Boulder's prior efforts to increase physical resilience. According to *Daily Camera* reporter Charlie Brennan, prior to the flooding, there had been extensive engineering efforts in the City of Boulder to channel flash floods to, "where it's not going to harm people or

infrastructure... in a way that is going to maximize public safety and minimize infrastructural damage.”

The prior preparedness could have influenced the greater focus on social resilience. However, I also found that the concern with social capital and social resilience often extended to areas that did not invest as much in physical resilience prior to the floods.

The unusual social context of Boulder County is a strength of the study even though it is not representative of the U.S. population (Tsang 2014). Non-representative areas like Boulder County have proved valuable for testing existing theories in a setting where the hypothesis is either most likely or least likely to occur, in what is called “crucial case” studies (Gerring 2007). Because of their views of climate change, one could view Boulder County as a “most likely” setting for climate action, which may provide theoretical insights that are not provided by more typical settings.

## CONCLUSION

This case study of Boulder County’s historic 2013 floods initially explored how the event affected climate-related beliefs and actions in Boulder County, Colorado. I found that Boulder County was already devoted to climate change action. I also found that after the flooding, there was greater concern with using social capital to increase resilience to future events. An analysis of community perceptions of the role of social capital in building resilience suggested that social capital was regarded as an important tool for building resilience, but I found that a complex relationship between social capital and climate resilience exists.

The example from Lyons shows an imbalance between levels of bonding and bridging social capital. Two other examples show that linking social capital was seen as a positive benefit in building resilience, and a loss of linking social capital seemed to damage resilience-building efforts. These results are consistent with existing theories of social capital, which is why policy implications such as increasing

social cohesion, encouraging bridging and linking social capital, and encouraging networks to form in communities have already been suggested (Aldrich and Meyer 2015). My research shows that after a disaster, there is a window of opportunity for including marginalized individuals and groups in policy decisions and for using bridging and linking social capital to create opportunities for public participation. These efforts could empower communities and enable vulnerable individuals and groups to take on important roles in disaster recovery, climate change action, and resilience-building. Climate change beliefs and actions are more common in Boulder County as compared to the rest of the United States, but recent surveys indicate that climate change beliefs could be on the rise. This case study could help to build a framework connecting social capital and climate resilience in a context where citizens and community leaders are actively aware about the issue and concerned about impacts.

## REFERENCES

- Adger, W. N. 2000. "Social and Ecological Resilience: Are They Related?" *Progress in Human Geography* 24(3):347–64.
- Adger, W. Neil. 2003. "Social Capital, Collective Action, and Adaptation to Climate Change." *Economic Geography* 79(4):387–404.
- Akter, Sonia, Jeff Bennett, and Michael B. Ward. 2012. "Climate Change Scepticism and Public Support for Mitigation: Evidence from an Australian Choice Experiment." *Global Environmental Change* 22(3):736–45.
- Albright, Elizabeth A. and Deserai A. Crow. 2015. "Learning in the Aftermath of Extreme Floods: Community Damage and Stakeholder Perceptions of Future Risk." *Risk, Hazards & Crisis in Public Policy* 6(3):308–328.
- Aldrich, Daniel P. 2012. *Building Resilience : Social Capital in Post-Disaster Recovery*. Chicago: University of Chicago Press.
- Aldrich, Daniel P. and Michelle A. Meyer. 2015. "Social Capital and Community Resilience." *American Behavioral Scientist* 59(2):254–69.
- Anon. 2015. "National Laboratories in Boulder | NCAR, NIST, NOAA | Boulder Colorado USA." *National Laboratories in Boulder*. Retrieved May 20, 2016 (<http://www.bouldercoloradousa.com/things-to-do/national-laboratories-in-boulder/>).
- Babbie, Earl R. 2009. *The Practice of Social Research*. 12 edition. Belmont, Calif: Cengage Learning.
- Babcicky, Philipp and Sebastian Seebauer. 2016. "The Two Faces of Social Capital in Private Flood Mitigation: Opposing Effects on Risk Perception, Self-Efficacy and Coping Capacity." *Journal of Risk Research* 0(0):1–21.
- Barabási, Albert-László. 2003. *Linked : How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life*. New York: Plume.
- Becker, Ernest. 1973. *The Denial of Death*. New York: Free Press.
- Bell, Shannon Elizabeth. 2009. "'There Ain't No Bond in Town Like There Used to Be': The Destruction of Social Capital in the West Virginia Coalfields." *Sociological Forum* 24:631–657.
- Bell, Shannon Elizabeth. 2016. *Fighting King Coal: The Challenges to Micromobilization in Central Appalachia*. Cambridge, MA: The MIT Press.
- Bostrom, Nick. 2002. "Existential Risks: Analyzing Human Extinction Scenarios." *Journal of Evolution and Technology* 9(1). Retrieved February 29, 2016 (<http://www.nickbostrom.com/existential/risks.html>).

- Boulder County, CO. 2016. "Climate." *Boulder County, Colorado*. Retrieved March 13, 2016 (<http://www.bouldercounty.org/env/sustainability/pages/energyclimate.aspx>).
- Boulder County Land Use. 2016. "Flood 2013 Inundated Areas." *Boulder County Geospatial Open Data*. Retrieved July 1, 2016 ([http://gis.bouldercounty.opendata.arcgis.com/datasets/a9624bd25d854ef7ab0d543e9490ce48\\_0](http://gis.bouldercounty.opendata.arcgis.com/datasets/a9624bd25d854ef7ab0d543e9490ce48_0)).
- Boulder County Land Use and US Forest Service. 2016. "Fourmile Canyon Fire Progression." *Boulder County Geospatial Open Data*. Retrieved August 23, 2016 ([http://gis.bouldercounty.opendata.arcgis.com/datasets/d14f74167be14b1eb033c6ddc48ce0de\\_0](http://gis.bouldercounty.opendata.arcgis.com/datasets/d14f74167be14b1eb033c6ddc48ce0de_0)).
- Bourdieu, Pierre. 1986. "The Forms of Capital." Pp. 241–58 in *Handbook of Theory and Research for the Sociology of Education*, edited by J. Richardson. New York, Greenwood.
- Brenkert-Smith, Hannah, James R. Meldrum, and Patricia A. Champ. 2015. "Climate Change Beliefs and Hazard Mitigation Behaviors: Homeowners and Wildfire Risk." *Environmental Hazards* 14(4):341–60.
- Bubeck, P., W. J. W. Botzen, and J. C. J. H. Aerts. 2012. "A Review of Risk Perceptions and Other Factors That Influence Flood Mitigation Behavior." *Risk Analysis* 32(9):1481–1495.
- Checker, Melissa. 2007. "'But I Know It's True': Environmental Risk Assessment, Justice, and Anthropology." *Human Organization* 66(2):112–124.
- Coleman, James S. 1988. "Social Capital in the Creation of Human Capital." *American Journal of Sociology* 95–S120.
- Cook, John et al. 2013. "Quantifying the Consensus on Anthropogenic Global Warming in the Scientific Literature." *Environmental Research Letters* 8(2):24024.
- Cox, Robin S. and Karen-Marie Elah Perry. 2011. "Like a Fish Out of Water: Reconsidering Disaster Recovery and the Role of Place and Social Capital in Community Disaster Resilience." *American Journal of Community Psychology* 48(3–4):395–411.
- Crimmins, A. et al. 2016. "The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment." Retrieved May 23, 2016 (<http://dx.doi.org/10.7930/JOR49NQX>).
- Dickinson, Janis L. 2009. "The People Paradox: Self-Esteem Striving, Immortality Ideologies, and Human Response to Climate Change." *Ecology and Society* 14(1):34.
- Farley, John W. 2008. "The Scientific Case for Modern Anthropogenic Global Warming." *Monthly Review* 60(03 (July-August)). Retrieved February 29, 2016 (<http://monthlyreview.org/2008/07/01/the-scientific-case-for-modern-anthropogenic-global-warming/>).

- Ferragina, Emanuele and Alessandro Arrigoni. 2016. "The Rise and Fall of Social Capital: Requiem for a Theory?" *Political Studies Review* 1478929915623968.
- Fleming, Melissa. 2009. "Climate Change Could Become the Biggest Driver of Displacement: UNHCR Chief." *UNHCR*. Retrieved May 21, 2016 (<http://www.unhcr.org/news/latest/2009/12/4b2910239/climate-change-become-biggest-driver-displacement-unhcr-chief.html>).
- Gerring, J. 2007. "Is There a (Viable) Crucial-Case Method?" *Comparative Political Studies* 40(3):231–53.
- Gilding, Paul. 2012. *The Great Disruption: Why the Climate Crisis Will Bring on the End of Shopping and the Birth of a New World*. New York, NY: Bloomsbury Press.
- Hawkins, Robert L. and Katherine Maurer. 2010. "Bonding, Bridging and Linking: How Social Capital Operated in New Orleans Following Hurricane Katrina." *British Journal of Social Work* 40(6):1777–93.
- Hesse-Biber, Sharlene Nagy. 2011. *The Practice of Qualitative Research*. 2nd ed. Los Angeles: SAGE.
- Homer-Dixon, Thomas F. 2006. *The Upside of down : Catastrophe, Creativity, and the Renewal of Civilization*. Washington: Island Press.
- Jordan, Joanne Catherine. 2015. "Swimming Alone? The Role of Social Capital in Enhancing Local Resilience to Climate Stress: A Case Study from Bangladesh." *Climate and Development* 7(2):110–123.
- Kahan, Dan M. et al. 2011. "The Tragedy of the Risk-Perception Commons: Culture Conflict, Rationality Conflict, and Climate Change." *Temple University Legal Studies Research Paper* (2011–26). Retrieved ([http://papers.ssrn.com/sol3/Papers.cfm?abstract\\_id=1871503](http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=1871503)).
- Kellens, Wim, Ruud Zaalberg, Tijs Neutens, Wouter Vanneuville, and Philippe De Maeyer. 2011. "An Analysis of the Public Perception of Flood Risk on the Belgian Coast (Report)." *Risk Analysis* 31(7):1055.
- Keys, Noni, Dana C. Thomsen, and Timothy F. Smith. 2016. "Adaptive Capacity and Climate Change: The Role of Community Opinion Leaders." *Local Environment* 21(4):432–50.
- Leiserowitz, A., G. Feinberg, P. Howe, and S. A. Rosenthal. 2013. *Climate Change in the Coloradan Mind: July 2013*. Yale University. New Haven, CT: Yale Project on Climate Change Communication.
- Leiserowitz, A., E. Maibach, C. Roser-Renouf, G. Feinberg, and P. Howe. 2013. *Climate Change in the American Mind: Americans' Global Warming Beliefs and Attitudes in April 2013*. Yale University and George Mason University. New Haven, CT: Yale Project on Climate Change Communication.
- Leiserowitz, A., E. Maibach, C. Roser-Renouf, G. Feinberg, and S. Rosenthal. 2015. *Climate Change in the American Mind: October, 2015*. Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication.

- Leiserowitz, A., E. Maibach, C. Roser-Renouf, G. Feinberg, and S. Rosenthal. 2016. *Climate Change in the American Mind: March, 2016*. Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication.
- Lo, Alex Y. and Lewis T. O. Cheung. 2016. "Geographies of Social Capital: Catastrophe Experience, Risk Perception, and the Transformation of Social Space in Postearthquake Resettlements in Sichuan, China." *Annals of the American Association of Geographers* 106(4):874–90.
- Marín, Andrés, Örjan Bodin, Stefan Gelcich, and Beatrice Crona. 2015. "Social Capital in Post-Disaster Recovery Trajectories: Insights from a Longitudinal Study of Tsunami-Impacted Small-Scale Fisher Organizations in Chile." *Global Environmental Change* 35:450–462.
- Maxwell, Joseph Alex. 2005. *Qualitative Research Design: An Interactive Approach*. 2nd ed. Thousand Oaks, Calif: Sage Publications.
- McCarthy, John F. 2014. "Using Community Led Development Approaches to Address Vulnerability after Disaster: Caught in a Sad Romance." *Global Environmental Change* 27:144–155.
- Miles, Matthew B., A. M. Huberman, and Johnny Saldaña. 2014. *Qualitative Data Analysis: A Methods Sourcebook*. Third edition. Thousand Oaks, California: SAGE Publications, Inc.
- Milward, H. Brinton and Keith G. Provan. 2006. *A Manager's Guide to Choosing and Using Collaborative Networks*. IBM Center for the Business of Government Washington, DC.
- Narayan-Parker, Deepa. 1999. *Bonds and Bridges: Social Capital and Poverty*. World Bank Publications.
- Norgaard, Kari Marie. 2011. *Living in Denial: Climate Change, Emotions, and Everyday Life*. Cambridge, Mass: MIT Press.
- Pachauri, R. K., Leo Mayer, and Intergovernmental Panel on Climate Change, eds. 2015. *Climate Change 2014: Synthesis Report*. Geneva, Switzerland: Intergovernmental Panel on Climate Change.
- Parr, Adrian. 2012. *Wrath of Capital : Neoliberalism and Climate Change Politics*. New York: Columbia University Press.
- Patton, Michael Quinn. 1999. "Enhancing the Quality and Credibility of Qualitative Analysis." *Health Services Research* 34(5):1189.
- Paxton, Pamela. 1999. "Is Social Capital Declining in the United States? A Multiple Indicator Assessment." *American Journal of Sociology* 105(1):88–127.
- Pelling, Mark. 1998. "Participation, Social Capital and Vulnerability to Urban Flooding in Guyana." *Journal of International Development* 10(4):469–86.
- Pelling, Mark and Chris High. 2005. "Understanding Adaptation: What Can Social Capital Offer Assessments of Adaptive Capacity?" *Global Environmental Change* 15(4):308–319.

- Putnam, Robert D. 2000. *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.
- Robson, Colin. 2011. *Real World Research: A Resource for Users of Social Research Methods in Applied Settings*. 3rd ed. Chichester, West Sussex: Wiley.
- Sapirstein, Guy. 2006. "Social Resilience: The Forgotten Dimension of Disaster Risk Reduction." *Jàmbá: Journal of Disaster Risk Studies* 1(1):54–63.
- Satterthwaite, David. 2013. "The Political Underpinnings of Cities' Accumulated Resilience to Climate Change." *Environment & Urbanization* 25(2):381–391.
- Semenza, Jan C. et al. 2008. "Public Perception of Climate Change: Voluntary Mitigation and Barriers to Behavior Change." *American Journal of Preventive Medicine* 35(5):479–487.
- Shepherd, Christin. 2016. "Open Data Catalog." *City of Boulder: September 2013 Flood Extents*. Retrieved July 1, 2016 (<https://bouldercolorado.gov/open-data/city-of-boulder-september-2013-flood-extents/>).
- Szreter, Simon and Michael Woolcock. 2004. "Health by Association? Social Capital, Social Theory, and the Political Economy of Public Health." *International Journal of Epidemiology* 33(4):650–667.
- Talmey-Drake Research & Strategy, Inc. 2013. *2013 Boulder City/County Climate Issues Survey*. Retrieved ([https://www-static.bouldercolorado.gov/docs/02\\_20\\_2014\\_SS\\_Updated-1-201402181717.pdf](https://www-static.bouldercolorado.gov/docs/02_20_2014_SS_Updated-1-201402181717.pdf)).
- Tilt, Bryan and Drew Gerkey. 2016. "Dams and Population Displacement on China's Upper Mekong River: Implications for Social Capital and Social–ecological Resilience." *Global Environmental Change* 36:153–62.
- Tsang, Eric W. K. 2014. "Generalizing from Research Findings: The Merits of Case Studies." *International Journal of Management Reviews* 16(4):369–83.
- Tzanakis, Michael. 2013. "Social Capital in Bourdieu's, Coleman's and Putnam's Theory: Empirical Evidence and Emergent Measurement Issues." *Educate* ~ 13(2):2–23.
- U.S. Geological Survey. 2015. "The National Map: Elevation." Retrieved July 1, 2016 (<http://nationalmap.gov/elevation.html>).
- VijayaVenkataRaman, S., S. Iniyan, and Ranko Goic. 2012. "A Review of Climate Change, Mitigation and Adaptation." *Renewable and Sustainable Energy Reviews* 16(1):878–97.
- Wachinger, Gisela, Ortwin Renn, Chloe Begg, and Christian Kuhlicke. 2013. "The Risk Perception Paradox-Implications for Governance and Communication of Natural Hazards: The Risk Perception Paradox." *Risk Analysis* 33(6):1049–65.



- Walker, Brian Harrison. 2006. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*. Washington, DC: Island Press.
- Weber, Elke U. 2006. "Experience-Based and Description-Based Perceptions of Long-Term Risk: Why Global Warming Does Not Scare Us (Yet)." *Climatic Change* 77(1-2):103-20.
- Woolcock, Michael. 2001. "The Place of Social Capital in Understanding Social and Economic Outcomes." *Canadian Journal of Policy Research* 2(1):11-17.
- York, Richard and Brett Clark. 2007. "The Problem with Prediction: Contingency, Emergence, and the Reification of Projections." *Sociological Quarterly* 48(4):713-43.

## APPENDICES

## Appendix A: Interviewees

<b>Name</b>	<b>Affiliation</b>	<b>Date</b>	<b>Type of Interview</b>
Matt Appelbaum	Mayor of Boulder from 2011 - 2015; executive committee of local chapter Sierra Club	Feb. 29, 2016	Phone
Erika Archer	Jamestown Flood Project Manager	Apr. 20, 2016	Phone
Millissa Berry	Town Planner (Jamestown)	Apr. 19, 2016	Phone
Susan Becker	Boulder Public Library: Maria B. Rogers Oral History Project	Feb. 23, 2016	In person*
Charlie Brennan	Daily Camera Reporter	Feb. 23, 2016	In person
Michael Chard	Director, Office of Emergency Management, Boulder County	Apr. 18, 2016	Phone
Cindy Domenico	Boulder County Commissioner	Apr. 29, 2016	Phone
Tiernan Doyle	BoCo Strong, Boulder Flood Relief	Apr. 18, 2016	Phone
Dan Eamon	Longmont Emergency Manager	Feb. 25, 2016	In person
Elise Jones	Boulder County Commissioner	Apr. 21, 2016	Phone
Chris Meschuk	City of Boulder Flood Recovery Project Manager	Feb. 25, 2016	In person*
Cyns Nelson	Boulder Public Library: Maria B. Rogers Oral History Project	Feb. 23, 2016	In person*
Aly Nicklas	Mudslingers organizer	Feb. 23, 2016	In person
John O'Brien	Mayor of Lyons from 2014 - 2016	Apr. 15, 2016	Phone
Micah Parkin	Executive Director, 350 Colorado	Feb. 24, 2016	In person
Garry Sanfaçon	Boulder County Flood Recovery Manager	Feb. 24, 2016	In person
Brad Schol	Longmont Special Projects Manager	Feb. 26, 2016	In person
Victoria Simonsen	Lyons Town Administrator	Apr. 19, 2016	Phone
Joel Wagner	City of Boulder Flood Recovery Project Manager	Feb. 25, 2016	In person*
Thomas Wells	Executive Director of Boulder Flood Relief	Feb. 22, 2016	In person

\* Indicates double interview

## Appendix B: Interview Guide

### **Interview Guide: Community Reactions to Extreme Weather Events**

#### ***Interview verbal consent guide:***

You are invited to participate in a research study, conducted by Oregon State and Stanford Universities and funded by the National Science Foundation, about community reactions to extreme weather events. You will be asked to participate in an interview about the community reaction to [extreme weather event name] in terms of both community mobilization and policy change.

With your permission, the interview will be audio-taped. These tapes will be transcribed for data analysis purposes and then destroyed after completion of the study.

Your participation will take approximately one hour.

There are minimal risks and no direct benefits associated with your participation in this study. You will not receive compensation for your participation.

Please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to answer particular questions. With your permission, your identity will be made known in written materials resulting from the study. Otherwise, your individual privacy and confidentiality of the information you provide will be maintained in all published and written data resulting from the study to the extent permitted by law.

#### ***If consenting by phone:***

If you have any questions about this study, or about anything else, you can contact me at [interviewer contact info] or the study's Principal Investigators – Dr. Hilary Boudet at [phone number] or Dr. Doug McAdam at [phone number] – or the Oregon State University Institutional Review Board at [phone number] or the Stanford Institutional Review Board at [phone number] or toll free at [phone number].

#### ***If consenting face to face:***

I will provide you with my contact information if you have any questions for me about this study, or anything else. The card I am giving you also has the contact information for the Oregon State and Stanford Institutional Review Boards (IRBs) if you have any questions about your rights as a participant.

## Generic Protocol

1. Do you have any questions before we begin?
2. Can you introduce yourself and talk about your role as it relates to the flooding?
3. In your view, what was the city like prior to the event?
  - a. Had there been similar flooding events? If so, what was the community response then?
  - b. What issues were people in Boulder passionate about before the 2013 flooding?
  - c. What social and environmental issues were people involved with before the event?
  - d. What political issues were most important prior to the event?
4. Switching to after the event, can you talk about some of the impacts? How did the community change?
  - a. policy changes
  - b. emergency response
  - c. preparedness for future events – individual and community
  - d. perceptions of risks of future events
  - e. economic health
  - f. exit from community
  - g. engagement in land use decisions
  - h. collective activity
5. Do you think these changes are directly related to the event or they would have happened eventually anyway?
6. Have these changes been lasting?
7. What impact has the event had on you personally, professionally?
8. Do you think the event affected certain groups of people more than others?
9. Climate change:
  - a. How has the experience of this event changed thoughts / perceptions about global warming / climate change for you? For community members?
  - b. How has the experience of this event changed the community conversation about climate change?
  - c. Are you aware of any efforts by community members or organizations to engage individuals or prompt action regarding environmental issues, particularly climate change, in the wake of the event?
10. Other?
  - a. Things you thought we would discuss and didn't?
  - b. Other sources of information?
  - c. Other people to interview/get in touch with?

## Environmental Group Protocol

1. Do you have any questions before we begin?
2. Can you introduce yourself and talk about your organization and its role in the flooding?
3. What was your organization like prior to the event?
  - a. What were the major issues/policy discussions the organization was concerned with prior to the flooding?
  - b. How did the organization get involved after event? Did priorities shift?
4. What were some of the main impacts after the event in the community (beyond fatalities and property damage)? How did the community change?
  - a. policy changes
  - b. emergency response
  - c. preparedness for future events – individual and community
  - d. perceptions of risks of future events
  - e. economic health
  - f. exit from community
  - g. engagement in land use decisions
  - h. collective activity
5. Do you think these changes are directly related to the event or they would have happened eventually anyway?
6. Have these changes been lasting?
7. Do you think the event affected certain groups of people more than others?
8. Climate change:
  - a. How has the experience of this event changed thoughts / perceptions about global warming / climate change for you? For community members?
  - b. How has the experience of this event changed the community conversation about climate change?
  - c. Have you used the event in messaging around environmental issues, particularly climate change? If so, how and what effects do you think it's had (on donations, meeting attendance, awareness, etc.)?
9. Other?
  - a. Things you thought we would discuss and didn't?
  - b. Other sources of information?
  - c. Other people to interview or get in touch with?

## Appendix C: Codebook

Code	Sub-code	Description
<b>Climate Change Beliefs</b>		
	Personal	What people say about their own beliefs
	Community	What people say about community beliefs
	Political	Government entities' language and policy regarding climate change
<b>Risk</b>		
	Vulnerability	How impacts or lack thereof affected people, government, and groups' sense of vulnerability, awareness of risks, etc.
	Perception of future	Perceptions of future events or risk of future impacts
	Action	A sense of urgency; needing to prepare or take action -- would not otherwise fit under "Resilience"
	Empowerment	Whether people feel that they are <i>able</i> to take actions, prepare, or recover; actions that were taken; or a sense of control over the situation
<b>Resilience</b>		
	Sustainability	General statements about sustainability, or about the relationship between sustainability and resilience
	Physical Resilience	Building roads, bridges, etc.
	Social Resilience	Building relationships, cooperation, capacity for groups & communities to cope, adapt, and maintain relationships and community (social capital)
	Ecological Resilience	Building natural buffers, protecting natural areas, etc.
	"Co-benefits"	Two or more types of resilience; connections between them
<b>Social Capital</b>		
	Government Collaboration	How local government dynamics – city to city or city to county/state relationships – affects social capital

Bonding	Neighbors helping neighbors, friends forming grassroots groups, sharing info & resources within neighborhoods and communities, etc.
Bridging	Relationships between people and groups with different characteristics, grassroots groups helping strangers, info & resource sharing that crosses group boundaries, etc.
Linking	Joint efforts between the public, & private, nonprofit, grassroots groups; relationships between citizens and local government
<b>Social Impacts</b>	
Differential Impacts	Mention of the event itself having a greater impact on certain groups, such as the elderly or poor
Government Trust	How people's trust & relationship with local government changed
Social Marginalization	Whether power differentials or social hierarchies impacted certain groups

#### Appendix D: Areas in this study

Area	Colorado	Boulder County	Boulder	Longmont	Lyons	Jamestown
2010 Population**	5,029,196	294,567	97,385	86,270	2,038	274
2015 Population	5,456,574	319,372	107,349	92,088	2,147	264
High School Degree or Higher	90.40%	94%	95.60%	87.50%	97.90%	100%*
Bachelor's Degree or Higher	37.50%	58.20%	71.50%	37.10%	57.4%*	78.8%*
Median Household Income	\$59,448	\$69,407	\$58,062	\$60,218	\$90,603	\$68,729*
Individuals below poverty level	13.10%	14.60%	23.20%	15.00%	9.50%	8.00%

Sources: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

\* City-Data.com; 2016 Advameg, Inc.; \*\*U.S. Census Bureau, 2010



