Learning processes, public and stakeholder engagement: Analyzing responses to Colorado's extreme flood events of 2013

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ABSTRACT

In early fall of 2013 in the Front Range of Colorado, several communities experienced intense rainfall over a three-day period, exceeding annual average precipitation rates. Extensive damage occurred to roads, infrastructure, parks, river corridors, homes and business throughout the region. Across the U.S. and in other nations, as population increases in flood-prone areas, flood risks and vulnerability are increasing as well. Successful response to extreme events may be due to policy learning—changes of beliefs, attitudes, behaviors, and goals – in response to new information and experiences. This learning can at times lead to adaptation of local policies to increase the resilience of communities faced with risk from extreme events. The extent of policy learning may depend on how communities engage with stakeholders and the public in post-disaster recovery. Using a comparative in-depth case study approach of seven Colorado communities, this study examines how communities actively engage stakeholders and the public in decision processes after an extreme event.

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1. Introduction

As summer of 2013 turned to fall in the Front Range of Colorado, over 16 inches of rain fell in a three-day period in some areas, totaling more than annual average precipitation rates (Henson, 2013). Towns such as Boulder, Lyons, Longmont, and others that sit at the mouths of mountain canyons, experienced flash flooding. When the rain and water moved east toward the plains, other towns such as Evans and Milliken were devastated. Infrastructure throughout the region was damaged, if not destroyed. Immediate road repairs cost over $450 million and costs are expected to rise as permanent repairs are completed (Whaley, 2013). Many residents' homes became uninhabitable, and many residents were under no-flush restrictions, with Evans under such restrictions for eight days. In Lyons over 20% of the housing was destroyed or severely damaged and over 1000 residents in Evans lost their homes. Beyond these most basic problems, business, community parks, and open space were also affected.

As population density increases in flood-prone areas, community vulnerability to flood risk is escalating. Along with this trend, in the U.S. the responsibility to design strategies and policies to mitigate flood risk is shifting from the federal government to states and localities (Brody et al., 2009). In the wake of a flood, communities must make decisions about whether,

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where, and how to rebuild, as well as whether to adopt changes in zoning and floodplain uses. Communities may need to repair or rebuild key public infrastructure, roads, storm sewers, and wastewater management systems. Floods may allow communities an opportunity to learn from their experiences and adjust their policies going forward. Flood management decisions may lead to increased community resiliency or continuing vulnerability to future flood events. By reflecting on past policies, modifying former policies, or adopting new policies, communities may become less vulnerable to future flood risk. How communities engage with stakeholders and the public during these recovery processes may impact local-level flood management practices. By examining the policy and decision processes conducted in response to the September 2013 floods in seven Colorado communities, this study examines how communities actively engage stakeholders and the public in decision processes. To understand if and how communities eventually learn during their recovery processes, is critical to first understand the decision processes that occur that may either encourage or limit learning from the experience of the floods.

2. Learning in response to extreme events

Learning in response to an extreme event may take many forms. Communities may identify policy failures or draw new conclusions about relationships, networks, and organizational structure (organizational learning). Policy learning – changes of beliefs, attitudes, goals, or behaviors – in response to new information may occur in response to extreme events (Sabatier and Weible, 2007; Albright, 2011). These overlapping concepts of learning may encourage adaptation of local policies to increase the resilience of communities faced with risk from extreme events. There are several potential driving factors that may explain variation in learning in response to extreme events: extent of flood damage, resource availability (e.g., financial, technical, human capacity), structure and openness of decision-making processes, and type of stakeholder participation in recovery (Brody, 2003; Johnson et al., 2005; Brody et al., 2009; Albright, 2011; Vulturius, 2013). Researchers argue that collaboration and collaborative processes are key components to the formation of the development of resilient cities (Godschalk, 2003).

2.1. Policy change and learning

The policy change and crisis literatures posit several potential causal mechanisms that may explain the occurrence of policy change and learning in the aftermath of an extreme event or crisis (Nohrstedt and Weible, 2010; Sabatier and Weible, 2007). One such framework, the Advocacy Coalition Framework (ACF) is based on groups or coalitions of stakeholders and defines policy-oriented learning as changes in beliefs held by these coalitions of policy actors (Sabatier and Jenkins-Smith, 1999). Several additional concepts inform the theoretical landscape of learning in response to an extreme event, such as social learning, political learning and instrumental learning (Bennett and Howlett, 1992; May, 1992). While the reflection of past experiences and the collection of new information are central to a variety of learning concepts, the content of what is learned and who learns varies across theoretical frameworks (Birkland, 1997, 2004, 2006; Busenberg, 2001; Sabatier and Jenkins-Smith, 1993; May, 1992; Bennett and Howlett, 1992).

The extent and type of learning that occurs in response to an event may depend on the complexity, severity, and distribution of the policy problem (i.e. the extent of flood damage); the level of conflict among advocates competing for their recovery policy goals; resources and shifts in resource availability; and the occurrence of professionalized meetings or broader community participatory processes (i.e. meetings or workshops) at which individuals from potentially competing advocacy coalitions meet (Sabatier, 1999). The accumulation of information and its subsequent exchange among competing coalitions may play a significant role in encouraging learning. Collaborative decision-making processes, if they occur, may provide such fora or venues for learning to occur.

2.2. Participatory and decision-making processes

In the wake of extreme flooding, communities will be faced with decisions about how to respond and what future plans to make regarding emergency management, rebuilding, and similar issues. Community staff and elected officials must decide how and to what extent to involve stakeholders in decisions regarding flood recovery (Kweit and Kweit, 2004). Herein, we define stakeholders as both government and non-state actors who have an interest and voice in the decision-making process. How a community conducts participatory and decision-making processes in response to floods may help explain what type and to what extent policy learning occurs. This study, therefore, examines the links between a shock (i.e., the floods in Colorado), damage incurred, resource availability, and subsequent local-level participatory processes to inform flood recovery.

Participatory or stakeholder processes vary along multiple dimensions, including type of participants (e.g., government, civil society organizations, experts, citizens); scale of process (e.g., local, regional, national) (Margerum, 2008); the level or type of governance (e.g., government-led, citizen-led, hybrid) (Moore and Koontz, 2003; Steelman and Carmin, 2002); and degree to which participation directly leads to decision outcomes (e.g., public hearings, public advisory committee, consensus meetings, citizen juries) (Beierle, 2002; Rowe and Frewer, 2000; Hansen and Mäenpää, 2008). According to Arnstein (1969), the depth of participation (as discussed in the "ladder of participation") can vary from minimal, with passive

information dissemination to much more active 'citizen control'. Further, collaborative processes range from bottom-up approaches of locally-initiated collaborations to top-down government-led programs.

2.3. Participatory process selection post disaster

While the literature on the typology and dimensions of participatory processes is robust (Reed, 2008), less is known about the forces that drive the selection of a specific participatory process or governance structure (Bingham et al., 2005). This is particularly true for participatory processes that stem from crises or disasters, where individual case studies dominate the literature. Historically, government agencies involved in natural disaster management have adopted a managerial approach, where government agencies, by and large, have led hazard response and mitigation, in other words disaster management 'for the community' not 'by the community' (Drabek, 1986; Pearce, 2003). In this managerial form of governance, stakeholders may be consulted and help inform decisions, but are not called upon to directly participate in decision-making processes. As the focus of disaster management has shifted from response to hazard mitigation and planning, the inclusion of stakeholders in participatory decision processes has become more prevalent (Pearce, 2003). With this merging of hazard management and planning processes, understanding how communities navigate the recovery process, especially in terms of the selection of participatory (or not) processes is an area ripe for investigation.

Several factors may influence what approach a community takes in structuring its decision-making processes regarding recovery, including tractability of the problem and history of collaboration. Community staff and officials may select more in-depth community-level participatory processes when issues are relatively easy to understand and local-level support is critical for implementation (Steelman and Carmin, 2002). Government-led stakeholder processes may work best in managing more complex issues and where there is limited local-level concern for the issue. Highly technical issues may not allow for inclusion of a wide array of stakeholders to participate in discussions without time allocated for technical information sharing. A history of successful past stakeholder and participatory processes may encourage participatory practices in the face of disaster—as Pearce (2003) argues, past successful collaborative processes may promote future collaboration.

The post-disaster supply of resources (e.g., financial, technical, network) may, at least in part, determine the type of participatory approach selected by local government officials. Technical, network and financial resources are often necessary to foster capacity development for local or community-based management—an approach that includes in-depth local-level stakeholder participation (Steelman and Carmin, 2002), whereas a lack of capacity may discourage communities from involving a wider selection of stakeholders and in-depth deliberation in decision-making processes. In the aftermath of an extreme event, we may see increased resources (e.g., inflow of external funds or emergent leadership) and/or the redistribution of resources including financial and technical resources, access to decision makers and decision-making authority, mobilization of supporters, and public opinion (Sabatier and Weible, 2007; Albright, 2011). These shifts in resources after an event may influence how and to what extent local governments chose to incorporate stakeholders in their recovery processes. Political resources may matter as well, such as the timing of the extreme event in relation to upcoming elections, potentially influencing how political officials frame the event (Boin et al., 2009). This analysis will identify resource availability immediately post-disaster, in part driven by shifts in resources due to the flood.

The hazard mitigation literature suggests that governments struggle in motivating individuals to participate in hazard mitigation planning (Birkland, 1996; Burby, 2003; Brody et al., 2003). However, the extent of damages caused by flooding may influence the willingness of individuals to participate in flood recovery processes. Direct experience of floods may increase the salience of flooding as an issue that needs to be managed. Extreme floods, causing community- and individual-level damage, may alter how individuals (i.e., stakeholders, the public) perceive future risks (Wachinger et al., 2013) and problem severity. These perceptions may in turn influence the willingness of individuals to participate in flood recovery processes. The severity of flood damage experienced may be directly positively linked with flood risk perception potentially increasing willingness to participate in flood mitigation processes. In this paper, individual flood experiences will be studied through an analysis of the extent of flood damage throughout the community and its link to level of public engagement in recovery processes.

2.4. Potential link between participatory process and learning

Groups and individuals who are not considered political elites or experts may be able to influence political discourse in more open, collaborative processes—which may in turn lead to policy learning (Albright, 2011). Communities with more open and democratic participatory processes may display a greater depth and extent of policy learning. The openness of governance, however, has not been viewed as a central element of disaster response and policy adaptation to extreme events. How recovery processes are structured may influence policy change and learning outcomes reached in response to disaster.

If experts dominate a decision process, citizens are typically less likely to become involved and the processes themselves are less open to participation (Crow, 2010; Schneider and Teske, 1992). These experts can have easier access to decision processes and elite decision makers due to their political or professional expertise. Schneider and Ingram (1997) also argue that expert language can be used to marginalize citizen engagement and prevent participation by non-expert actors, which suggests that when experts are granted higher levels of access to decision makers, citizens might be less central to decision processes. If processes are less open to non-expert stakeholders, new actors and/or new ideas may not be likely to enter decision processes, which may limit learning by individuals or organizations.

These connections between participation and learning have been explored mostly theoretically by policy scholars. This study will analyze the participatory pre-conditions we argue are essential to policy learning in the aftermath of an extreme event. Future studies must still link these pre-conditions to eventual learning outcomes. By moving the scholarship forward focused on participation, we hope to contribute to the eventual dialogue on learning outcomes as well.

3. Research questions and hypotheses

Based on the literature outlined above, we expect these participatory processes to be more robust in communities where (1) the extent and type of damage is more severe and widespread and (2) greater resource availability post-disaster. The following research question and associated hypotheses will be examined in this paper to understand post-disaster recovery processes held across communities in Colorado.

RQ1: How do learning processes, specifically the depth of stakeholder participation and extent of public input differ across communities in response to extreme flooding?

H1. Participatory processes will (a) engage stakeholders at a more in-depth level and (b) incorporate more public input with increased flood damage and increased scope of damages.

H2. Communities with greater post-flood resource availability (e.g., financial, technical, relationship/network, public support) will demonstrate (a) greater depth of stakeholder participation and (b) more public input in flood recovery processes.

4. Multi-method comparative case study research design

Using a comparative in-depth case study approach (Yin, 2003) of seven Colorado communities, the research question and hypotheses posited above are examined next. These seven communities are situated within the three Colorado counties (Boulder, Weld, and Larimer) most affected by the 2013 floods (Federal Emergency Management Agency, 2013). The seven communities vary across size, demographics (Table 1), extent, and type of flood damage (Table 2). Data collected for this paper are detailed below.

4.1. Data collection and analysis

4.1.1. Data collection: interview and document data collection
In-depth semi-structured interviews (Rubin and Rubin, 2005) were conducted within each community. Initial interviews were conducted in November and December 2013 as each community transitioned from 'response' to 'recovery' phases (for example, Lyons did not move into recovery until December 18, 2013). These interviews ($n = 24$) provided background information on flood damages and general flood recovery. For this paper, we also systematically analyzed the interviews that were conducted with an individual in each community who managed, lead, or had the most knowledge of participatory flood recovery processes in their community. The transcripts were coded for three major themes as identified by the literature presented above: damages, resources, and participatory processes.

All documents related to flood management planning, participatory processes, evaluation of policies, and community responses to the floods were gathered and analyzed. This included all (1) public or media outreach released by municipal governments in the case communities, (2) city council minutes and memos in the case communities, (3) minutes from commissions and boards that discussed flood recovery within the communities, (4) planning session documents from each community, and (5) other documents as appropriate to each community. The timeframe of document collection included September 11, 2013 (the date the flood event began) through July 1, 2014.

4.1.2. Document and interview coding and analysis
Systematic coding of all of the documents ($n = 773$) and interview transcripts was conducted to identify major concepts and patterns across cases.[1] The documents were classified as to whether they were produced as a result of a meeting or used to inform a meeting or group decision-making process. The meeting-related documents were classified based on venue/type of decision-making meeting, such as city council, board or commission or task force meeting or a public meeting. The scope of the recovery process was coded in terms of number of sectors that recovery process involves, with a narrow scope defined as one central sector; moderate scope (2–3 sectors); and broad scope (>3 sectors). For each community, counts of number of meetings across meeting type were calculated along with the degree to which recovery was discussed in multiple decision-making venues. The codebooks for the documents and transcripts are shown in Appendices A and B respectively. Using NVivo software, we analyzed the data to examine variations and similarities among interview subjects, variables, and cases (Miles and Huberman, 2013).

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[1] Interview quotations used in this paper are cited using an alpha-numeric code to identify the community (BO = Boulder, LG = Longmont, LY = Lyons, EP = Estes Park, EV = Evans, GR = Greeley, and LV = Loveland).

Table 1
Demographics of case study communities.

County (population)	Community	Approx. size (2010 census)	Median household income (2008–2010 census)	% College graduate (2008–2010 census)
Boulder (295,169)	Boulder	101,800	$56,206	71.3
	Longmont	88,600	$57,142	37.3
	Lyons	2000	$73,918[a]	58.2
Larimer (299,630)	Loveland	67,039	$55,838	32.4
	Estes Park	6000	$57,789	48.3
Weld (254,241)	Greeley	95,300	$44,226	25.9
	Evans	19,500	$46,180	14.9

[a] Median household income and education attainment data for Lyons, CO was obtained from City-Data.com.

Table 2
Extent of flood-related damage across sectors in each community.

Community	Public works and infrastructure	Residential	River corridor	Parks, trails and open space
Boulder	• 50 municipal/facilities significantly damaged • Sewer and stormwater infrastructure and treatment facilities damaged • 60 miles of debris-covered road	• 50 housing units uninhabitable	• Applying for $500,000–$1 million from FEMA for debris/sediment removal	• 25 damaged areas of trail system • Hundreds of open space and mountain parks areas damaged
Longmont	• Storm drainage $74 million • Street repair $17 million • Sewer $4.6 million	• Mobile home park area experienced most damage	• $48 million in damage	• Parks $21 million damage • Two park closures
Lyons	• Significant damage to roads	• 20% of residences destroyed or severely damaged	• Significant damage, including shifting of river	
Loveland	• $20–$30 million in infrastructure damage	• Minor, little development in the floodplain		• Extensive damage to two city parks
Estes Park	• $30–40 million in damage, mostly to roads, bridges, and sewers	• Minor, along two specific river corridors	• Moderate to significant debris deposits • River moved up to 50 feet in some locations	
Evans	• Significant damage to infrastructure • Sewer system down 8 days	• Significant damage in specific mobile home parks		• Significant damage • Park closure
Greeley	• Minor[a]	• Minor	• Moderate debris removal costs	• Minor

[a] Minor damage denotes minor debris clean-up, street flooding in scattered areas throughout the community, but not significant damages.

5. Research findings

The process of recovery, including public outreach, participatory processes, and stakeholder involvement is important to understand in order to determine if these variables matter to policy learning over the long-term recovery period. To address RQ1 flood damage and resource availability will be discussed first, followed by a discussion stakeholder and participatory processes.

RQ1: How do learning processes and more specifically the depth of stakeholder participation and extent of public input differ across communities in response to extreme flooding?

5.1. Extent of flood damage and resource needs across communities

The extent of damage experienced by each of the communities is outlined in Table 2. As noted, Greeley suffered the least amount of damage, while Lyons experienced a loss of approximately 20% of its housing stock as well as significant infrastructure damage and the entire town of Lyons was evacuated for six weeks. The costs of recovery, especially in terms of its relative size compared to a community's annual budget, vary significantly across communities, with Lyons and Evans experiencing the greatest cost-to-budget ratios. Estes Park was not only affected directly by the flood, but also indirectly with a loss of tourists traveling to Rocky Mountain National Park (Estes Park is the 'gateway' to the National Park), and was also impacted by the federal government shutdown of the National Park and other federal lands in October 2013. Lyons, a small town that relies on a river-based tourist economy, lost tourism dollars as a result of the damages to the river corridor. See Table 3 for a breakdown of the flood-related costs for the case study communities.

Table 3
Resource availability across communities in the aftermath of the floods.

Community	Resource availability	Relevant quotations
Boulder	• Along with the FEMA and CO shares, this is manageable within the city budget and planning process • City staff and departments were able to handle initial minor repairs and they are contracting for larger work	"In comparison to the rest of the county, especially our northern neighbors, we are very lucky. We had no loss of life. I think there were 13 homes that were placarded as not habitable. The rest of the damage has mostly been underground." (BO-01)
Longmont	• Longmont immediately increased city Water and Sewer fees and the Park Fee for all residents to help pay for recovery • City staff and departments were able to handle initial minor repairs • They have prioritized the moderate and major projects and will contract for those, some of which will require grants from outside agencies and organizations	"Our three big priorities are reestablish the city's water supply, deal with 'the river', and then housing." (LG-01) "We're starting to dredge Longmont Reservoir, and as of this morning we're actually flowing water through the north pipeline all the way down to the treatment plant…so that's a major thing… there's lots left to do." (LG-02)
Lyons	• With an operating budget of $1 million annually, this far exceeds the town's capacity • Lyons is depending on outside agencies and volunteers to do assessments and repairs, and the State of Colorado to help defray more than the standard 12.5% • They have logged 35,000 volunteer hours between September and December • The state hired and paid for a recovery manager starting in January 2014	"When the water came through it ripped out all of the underground utilities with it. So we lost all connections to our wastewater plant, gas lines, electric lines, sewer lines, communication lines. We lost all access in and out of Lyons. In some cases the roads and bridges were totally washed out… no one in and no one out." (LY-01) "We had to evacuate all 2000 people and the National Guard did that." (LY-01)
Estes Park	• Cost is within the town's capacity, depending on whether Larimer County and federal highway funds contribute sufficient resources • Estes Park has met its FEMA match primarily through in-kind costs such as labor • Grant awarded by the Colorado Water Conservation Board	"We actually fared fairly well for everything that happened. We have several streams go through town…downtown was a river." (EP-01) "The road was pretty much completely destroyed, took out the sewer system and all utilities [in Fish Creek corridor]." (EP-01)
Loveland	• With the FEMA and state contributions, and insurance coverage, the costs should be within city's capacity • Loveland had updated floodplain maps twice in ten years in response to the 1997 Spring Creek flood in Larimer County.	"Within our urbanized area, our damage is primarily public infrastructure and only a distant second private property. The reason for that is the physical layout and the past regulatory environment which has prevented a lot of private development in the floodplain, has avoided that." (LV-01)
Evans	• Damage costs far exceed fiscal capacity of community • Evans has very limited resources to deal with the response and recovery	"And, you know, for a city of almost 20,000 that's a relatively small number of people. And our staff, especially our professional staff, the engineers and those kinds of folks, have been on flood duty almost full time sense September 13th. And that's been really stressful on our organization. We are just now going to hire a bunch of more temporary staff to work on these things because—as you know, these recovery things can go on for years." (EV-02)
Greeley	• Cost within town's capacity • Greeley increased contingency funds through budgeting process • Greeley had resources to aid Evans in emergency response	"We didn't have anything that went down and became completely unoperational. Just some damage that needs to be dealt with, so that it can continue to function as it's designed." (GR-01)

5.2. Resources and resource availability

Prior to, and in the wake of extreme events such as floods, each community has a unique composition of available resources. These resources may include fiscal, human, community support, networks, and technical assets or capacities. The basket of resources after a flood, including resource shifts that occur in response to an extreme event may dictate, in part, how a community approaches the recovery process. As shown in Table 1, the population size and average median income vary across case study communities in this analysis. These measures may serve as proxies for resource availability prior to the floods (e.g., size of government staff and budget are related to the local population/tax base).[2] Evans and Lyons, both small communities, differ in relative wealth, with Evans having a comparatively lower median household income. Boulder, the home of the University of Colorado's flagship campus, has a relatively high median household income, and a highly educated and relatively large population. Greeley and Evans, both located in Weld County, have lower median household incomes compared to other communities. The economic profiles of the communities vary as well, with the communities in Weld County having larger agricultural, industrial, and petroleum/natural gas extraction industries. Estes Park, with its proximity to Rocky Mountain National Park has a tourism-based economy.

Beyond town resources prior to the floods, the availability of resources post-flood (Table 3), in part driven by shifts in resources in response to the floods (Table 3) may also influence a town's ability to initiate and manage stakeholder and participatory processes. All communities are constrained, to varying extents, by budgets, staff (human capacity), and technical

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[2] Although we acknowledge that this is not a perfect measure since business taxes and sales taxes would not be reflected in such a measure. This is particularly relevant for Estes Park, which has a significant tourist economy.

capacity. All communities will seek reimbursement of varying amounts from FEMA for flood recovery costs. As a general practice, the standard FEMA cost-share is 75% of the amount of damage that is not covered by insurance. The State of Colorado will cover 12.5% of the remaining costs, with the expectation that each town will fund the remaining 12.5% of damage costs.[3] FEMA reimbursement and these cost shares frequently do not cover river corridor restoration unless these costs can be directly tied to flood hazard mitigation. Corridor restoration can be prohibitively costly, especially for communities where the riverbed shifted significantly.

In addition to fiscal resources, community managers and staff frequently mentioned the importance of an array of resources that have aided or will assist in immediate flood response and long-term recovery. Of these resources, relationships with non-governmental organizations, faith-based organizations, state and federal agencies, counties, other communities, and community members were seen as most important by interview subjects. Several interviewees also mentioned the importance of technical capacity, such as the ability to GPS map the high water line during the flood (Loveland) and public outreach using digital media during both response and recovery (e.g., Twitter, Facebook, Google groups, websites, etc.).

5.3. Variation in participatory processes

As described in the introduction, this study examines the relationships between flood damage, resource availability, and flood-recovery participatory processes, as put forth in our hypotheses:

H1. Participatory processes will (a) engage stakeholders at a more in-depth level and (b) incorporate more public input with increased flood damage and increased scope of damages.

H2. Communities with greater post-flood resource availability (e.g., financial, technical, relationship/network, public support) will demonstrate (a) greater depth of stakeholder participation and (b) more public input in flood recovery processes.

In response to the floods, city councils, commissions, stakeholders, and the public of each affected community began to assess and discuss the damages left in the wake of the extreme floods. These conversations occurred in a variety of venues in each of the communities. Table 4 displays the number of community-level meetings between September 2013 and July 2014 in which the floods were discussed. The number of total flood-related meetings[4] varies across communities, with Longmont holding the greatest number of meetings and Greeley the least. The topical focus of the meetings also varies across communities, with a greater focus on open space, trails, and parks in Boulder, Loveland and Longmont and more frequent discussion of infrastructure in Longmont, Loveland, and Estes Park (Table 5).

Community-level participatory approaches for flood recovery also differ across communities (Tables 6 and 7). Lyons is holding extensive and deliberative meetings on every aspect of recovery and asking citizens to volunteer for a committee on which they will serve (housing, parks and recreation, arts and culture, roads and bridges, infrastructure, public facilities, stream recovery, individual assistance, and businesses). Prior to the development of specific projects, each recovery group developed a set of goals, objectives, and priorities to help guide future decisions. In addition to the small recovery groups, Lyons involved the public via public meetings (with as many as 500 in attendance (Tables 6 and 7)) as well as participation through electronic means, including near-daily email updates on the status of flood recovery (Table 6).

Longmont has discussed floods in a large number of meetings and has engaged the public in the largest number of meetings, which focus primarily on park redevelopment and river corridor recovery (Table 5). Boulder has held a large number of public meetings, some focused on specific neighborhoods (Table 4), to address the issue of floodplain management (Tables 5 and 8). Boulder has also experienced a relatively high level of community involvement in open space and trail redevelopment, both through public meetings and public comment at city council meetings (Tables 5 and 6). As Boulder has engaged in a high-level of public outreach and information collection, their flood recovery process can best be described as consultation in terms of depth of participation (Table 7). Estes Park has engaged in a stakeholder (advisory committee) and public participatory process surrounding the Fish Creek corridor to repair infrastructure and a trail in the corridor. Approximately 140 individuals attended a public meeting associated with this process that has been funded with $78,000 from the Colorado Water Conservation Board.

Evans has formed a flood recovery task force that meets twice per month and covers a wide swath of topics (Table 4), potentially culminating in a proposed plan with recommendations for changes in land use plans, building codes, and other flood-related policy instruments—suggesting a relatively high rating of depth of participation based on Arnstein's ladder (1969). The task force meetings are open to the public, but no documents were found that indicate broad public outreach beyond the task force, in the recovery process. The meeting notes, nor the agendas, were posted on the town of Evans' website. Greeley, also located in Weld County, with its very limited flood damage did not speak of community-level involvement in flood recovery, nor do the documents suggest that extensive meetings were held in response to the floods (Table 4). Loveland is facing the recovery processes akin to traditional capital projects with design workshops but limited policy deliberation among stakeholders, strongly suggesting a managerial approach to recovery (Tables 6 and 7). An approximately

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[3] All of these figures apply after insurance has been paid on covered properties or assets.

[4] We define flood-related meetings as meetings in which meeting participants discussed at least one-flood related topic as documented in a meeting agenda, minutes or notes.

Table 4
Counts of local-level meetings September 2013–July 2014.[a]

Community	City/town council	Elected or appointed advisory commission/board	Flood task force	Public meeting	Total
Boulder	3	29	0	13	45
Longmont	27	19	0	11	57
Lyons	0	0	37	4	41
Loveland	16	25	0	3	44
Estes Park	20	18	1	4	43
Evans	9	5	4	0	18
Greeley	3	5	0	2	10
Total flood meetings	78	101	42	37	258

[a] Only documented meetings were included in these counts.

Table 5
Counts of flood-related meetings by major topics September 2013–July 2014.

Community	Broad recovery[a]	Public works[b]	Housing	Business/economic develop.	Landuse/ floodplain	Stream restoration	Parks, trails and open space
Boulder	16	3	0	0	7	1	18
Longmont	22	12	7	3	2	2	9
Lyons	11	5	10	5	0	5	5
Loveland	16	11	0	1	0	0	16
Estes Park	15	11	0	6	8	2	1
Evans[c]	7	2	0	2	3	0	0
Greeley	8	2	0	0	0	0	0
Total Flood Meetings	95	46	17	17	20	10	49

[a] Broad recovery encompasses those meetings that discussed overall damage assessment, budget, FEMA reimbursement, and planning processes and did not discuss specific topics such as residential, business, etc.
[b] Public works encompasses discussions of city infrastructure including roads, utilities such as power, gas, sewer, drinking water, and stormwater.
[c] Minutes were not available for the four Evans flood task force meetings and therefore were not included in the count.

Table 6
Mechanisms and fora through which residents have participated in and shared views on flood recovery.

	Task force/stakeholder process	City council/commission participation	Public meeting participation	Survey of residents	On-line information collection
Boulder	No	Yes	Yes	Yes	Yes
Longmont	Yes	Yes	Yes	Yes	No
Lyons	Yes	No	Yes	Yes	Yes
Loveland	No	No	No	No	No
Estes Park	Yes	Yes	Yes	No	No
Evans	Yes	No	No	No	No
Greeley	No	No	Yes	No	No

equal number of meetings have involved discussion of public works and parks and open space (Table 5), the latter which the community will engage the public in park redevelopment.

6. Discussion

In this paper, we posited two hypotheses: (1) participatory processes, including public input, will vary based on extent and type of flood damage; and (2) communities will engage stakeholders more in-depth in the recovery process depending on post-flood resource availability. Prior to the floods, each community had a unique set of resources and relationships that they bring to the recovery process. Layered on top these 'baskets' of resources (e.g., fiscal or budgetary, staff, technical expertise, community support), exists significant variation in the extent and type of flood damage incurred on each community – the amount of damage to public infrastructure, including parks and open space, private residences, and businesses, or a mix of all three sectors. The damage costs incurred as a percentage of annual budgets vary widely across the seven communities, as well as the ability to cover these expenses. Table 9 synthesizes flood damage, resource availability and participatory processes across all communities.

To summarize our findings, our analysis only partially supports Hypotheses 1 and 2. We found that the two communities that were most severely damaged by the floods initiated new participatory processes to engage stakeholders in multi-sector, in-depth deliberative processes (Lyons and Evans), supporting Hypothesis 1. However, these two communities are also the most resource constrained—countering Hypothesis 2. Communities with less extensive damage (or damages restricted one

Table 7
Components of flood recovery participatory processes.

Community	New ongoing flood institution	Participants	Depth/stakeholder role[a]	Scale/sector
Boulder	• No	• Staff, commission members, public	• Consultation: community-wide and neighborhood open public fora	• Moderate scope: focus on open space and floodplains
Longmont	• Yes, for park redevelopment	• Staff, public, commission	• Delegate power: stakeholder process for redevelopment of park	• Moderate scope: focus on park redevelopment
Lyons	• Yes, multiple sector organized resident-led flood task forces	• Public, staff, local businesses	• Citizen control: multiple sector-specific stakeholder process	• Broad scope: multi-sector processes
Loveland	• No, reliance on already established institutions	• Staff, council and commission members	• Zero to limited input from public in infrastructure, Consultation in future park redevelopment	• Moderate scope: focus on infrastructure and park redevelopment
Estes Park	• Yes, river corridor stakeholder process	• Staff, public, advisory committee, commission	• Consultation/delegate power: large-sized public forum, advisory committee	• Moderate scope: focus on river corridor restoration and infrastructure
Evans	• Yes, appointed flood task force	• Staff, city council, appointed task force	• Citizen control/delegate power: stakeholder process develops draft flood plan	• Broad scope: multiple sectors across community to develop flood recovery plan and make recommendation to city council
Greeley	• No	• Staff	• None	

[a] The classifications were based on the 'ladder of participation' outlined by Arnstein (1969). Citizen control sits at the top of the hierarchy in which participants maintain decision authority. The delegation of power suggests that the public has decision authority over specific programs. Consultation invites citizens to provide information into the decision-making process.

Table 8
Relevant quotations about participatory processes and public involvement in flood recovery.

Boulder	• "So the neighborhood meetings have been critical in that right now … it's almost like a debrief. We're asking the residents to come tell us what their experience was and also what they think, and it's been fascinating to watch them come to the flood maps and say, "No, that's not how it happened; this is how it happened." … It's kind of letting the community vent, but also debrief, because that will help us gather data." (BO-01)
Longmont	• "It really is a massive information campaign around, "You need to know. You need to know. You can track yourself. Here's where we are. This is what's happening." You know, regular updates, regular conversations, you know, interactive maps and videos and everything to try to get the information out. Once we get to a point where some of those critical infrastructure pieces are met, then we probably will involve them more." (LG-02)
Lyons	• "We had our kickoff meeting. And we invited the entire public. We did door-to-door flyers, hand delivered to every person saying we want your input. And last night we had about 500 there." (LY-01)
Loveland	• "I think we're probably going to have community work-shopping and community participation on Viestenz-Smith Mountain Park, pretty sure that we will have that on the south half of Fairgrounds Park as well… they would be driven really not as a special overall flood recovery process but individual projects." (LV-01)
Estes Park	• "From there, we split up and we had a Fish Creek meeting, just specific to Fish Creek. And we created a Fish Creek email list where we can—people can subscribe and we can then communicate directly with the Fish Creek property owners, and the same with Fall River. So we can talk about their specific goals. We just started with also making sure people introduce themselves so that neighbors start to meet neighbors." (EP-02)
Evans	• "In fact, we were having almost every day a public meeting at 10:00 to just update folks on where it was going… If you were north of 23rd street, you probably never knew anything happened except we got a lot of rain because once you got beyond—well, actually once you got beyond 35th, you weren't in the no-flush zone; you're in another basin, and so that goes to a different plant. And so we have a community that about almost 2/3rds of the community was initially affected by the no-flush, but once that was done, the event was over for them. And then, of course, we have the folks on the east side, who some of whom lost everything." (EV-01)
Greeley	• "You know, the press conferences and stuff that Evans had, to be able to inform people what's going on, but we didn't have to do anything of that in Greeley. Would have. It's in our plan, if necessary, but we didn't have to activate—fully activate and do those types of things in Greeley." (GR-01)

sector) were less likely to directly engage stakeholders in decision-making processes, but rather engaged through information collection in which residents inform government staff of their flood-related knowledge and policy preferences.

The degree to which communities seek input from the broad public does not neatly align with either extent of damages or amount of post-flood resources. Boulder, Longmont, Lyons and Estes Park demonstrated the most extensive public outreach and information collection in flood recovery. These four communities have, on average, the most educated public and per capita wealth of the seven communities. Instead of post-flood resource availability and extent of damages, the community demographics and existing governmental capacity may, at least in part, enable or encourage more developed public outreach in these communities. A relatively educated and wealthy populace may drive a political culture that encourages public input into government decision-making processes. As this research project continues, coding of pre-flood documents and a survey

Table 9

Synthesis of flood damage, resource availability, and participatory processes across case communities.

Community	Flood damage	Post-flood resource availability	Public engagement and participatory processes
Boulder	• Extensive open space damage • Moderate infrastructure damage	• Cost within city capacity	• Open process to public • Extensive outreach, especially concerning open space • Active collection of information from public on internet • Neighborhood-based meetings on floodplain management
Longmont	• Extensive damage to parks and river corridor • Moderate infrastructure damage	• Cost within city capacity with increase in water sewer fee and FEMA and state assistance	• Open process to public • Extensive outreach, especially concerning open space • Deliberative, long-term processes re park redevelopment
Lyons	• Extensive damage to residential and town core	• Cost far exceeds town capacity	• Open process to public, high level of public participation • Comprehensive, deliberative, long-term processes across all sectors of town life • Active collection of information from public on internet
Loveland	• Infrastructure damage • Damage to parks	• With FEMA, state and insurance contributions, costs within capacity	• Heavy reliance on already established government institutions–councils and commissions • Infrastructure/project-based approach to recovery • Public input for park redevelopment
Estes Park	• Extensive infrastructure damage in two corridors	• Cost within town capacity	• Stakeholder and public process for restoration of river corridors • High level of participation from public in one meeting, future meetings unclear
Evans	• Extensive damage to specific regions	• Cost far exceeds town capacity	• Limited public participation in recovery process • New flood recovery task force formed, open to public, information about task force actions not readily available • Rely heavy on already established government institutions: city council
Greeley	• Minimal damage	• Minimal costs	• Limited to no flood recovery public participation

of the public will enable a more robust analysis of the role of past participatory practices and public preferences toward participatory processes in influencing public engagement in a post-flood context.

In response to the floods of 2013, the communities have experienced shifts in resources, whether due to an influx of money from FEMA, state agencies or insurance payments, additional staffing and volunteer participation, or outside technical expertise from contractors and consultants. Stemming at least in part from these factors, each community has adopted its own process for incorporating the broader community into decisions surrounding recovery and future planning.

The findings based on analysis of documents and interview transcripts suggest that the greater extent of flood damage, *and* more limited post-flood resource availability, communities tend toward more in-depth and broader scaled stakeholder engagement. Lyons may, in part, be driven to develop extensive participatory processes due to the limited capacity of its Town Government. This, however, is not likely the complete picture. Evans, also with limited fiscal and staff capacity, has adopted a similar, although less intensive, approach to involving stakeholders compared to Lyons. The two task force processes vary on how participants were selected. In Evans, the government selected individuals to participate through an application process, while in Lyons, the multiple task forces were more self selected by topic area. Self-selection of stakeholders is seen as a much more inclusive process than election or nomination processes (Fung, 2003). Potential reasons for this central difference may include the capacity of the community to participate in such a process. The two towns differ in size, socioeconomics (Lyons is wealthier with higher levels of educational attainment), and the spatial patterning of the flood damage. Downtown Lyons, central to its economy, was heavily impacted while in Evans, lower socioeconomic status neighborhoods, including mobile home parks were most severely impacted.

In Boulder, where resources are available and resource needs are manageable, the City of Boulder has conducted neighborhood meetings to understand local knowledge about the flood event and solicit resident input (Table 8), has produced a series of technical studies of floodplain maps and open space areas, and has engaged the public through a number of means of information and policy preference collection. Boulder's participatory process, best described as community consultation, contrasts most significantly with Loveland, a community of roughly the same size and financial capacity. Whereas Boulder has engaged its citizenry in many aspects of flood recovery through consultation meetings and on-line surveys, Loveland has relied most heavily on elected government institutions and government staff to direct and manage flood recovery projects without significant public input.

7. Conclusion

The literature on stakeholder processes suggest that an array of participatory processes have been used in local-level environmental and water resource decision making and management, varying on participant type, scale of process, and method and type of public participation. The literature is less clear on the form and structure of participatory processes that develop in the wake of extreme events. In the context of the aftermath of the floods of Colorado in September 2013, we also found a diversity of stakeholder processes across our case communities. And, similarly to the literature, the processes we studied vary on how open, deliberative, and participatory they are. Our results suggest that extent and type of flood damage, and resource availability (pre- and post-flood) influence the type of participatory processes a town adopts. Our findings indicate that communities that experience extensive flood damage across multiple sectors *and* have limited financial capacity appear to be more likely to form in-depth deliberative processes and broad, multi-sector initiatives, as illustrated by Lyons and, to a lesser extent, Evans. Communities with less severe damage and more financial capacity to manage recovery tended to adopt a more narrow, sector-specific approach to recovery, although with varying levels of public outreach and consultation. The hazards literature suggests that governments may have difficulty in encouraging individuals to plan for disaster (Birkland, 1996; Burby, 2003; Brody et al., 2003) and have often taken a top-down managerial approach to disaster management (Drabek, 1986; Pearce, 2003). Our findings suggest that in a post-disaster context, communities that have suffered damage across many sectors and have limited financial capacity are likely to have motivated residents and interested organizations participate in recovery and planning processes, broadening the historically managerial approach to disaster management.

Research suggests that when a new venue opens encouraging an increase in diversity of voices and opinions, changes in policies might ensue. This may indicate that those communities with more open and deliberative processes, like those forming in Lyons, may motivate greater change and learning. Some cities have a more engrained culture in openness of city planning processes (e.g., Boulder), while other communities do not have a long history of these practices. The adoption of new modes and methods of community involvement in decision-making processes, such as seen in Lyons, for example, may lead to policy change and learning, both within government and in the town as a whole.

This study focuses on the links between flood damages, post-flood resource availability and participatory processes. Recognizing that additional variables may be at play in explaining post-flood participatory process selection, including, but not limited to, past collaborative processes (Pearce, 2003) and public preferences toward participation, it would be helpful to capture these variables through an analysis of pre-flood documents and a survey of resident attitudes toward participation. While this study is an important first step in understanding post-disaster recovery learning processes, this research will continue to follow the seven communities analyzed here to eventually assess influences of these processes (and other variables) on policy learning. Additionally, it would be useful for scholars to examine whether these patterns of participation and consultation found here are also present in other disasters, and in communities that are not connected by a common disaster event such as the Colorado floods. Finally, to further understand the depth of participation used by communities, it would be helpful to conduct survey or interview research with recovery participants (staff, task force members, public) to understand the processes rules and expectations to a greater extent as well as the satisfaction of participants.

Notes

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2. Originally presented at the 2014 Annual Meeting of the American Political Science Association, Washington, D.C., August 28th–31st, 2014.

Appendix A. Codebook for interview transcripts

Coding instructions:
- Coders should read through the full transcript prior to beginning coding
- Coders should review codebook before coding
- When coding, coders should:
  - Code entire sentences, including any necessary contextual information around that sentence (when appropriate or necessary)
  - If coding for a single word using a 'find' search, read the entire question response by the subject in order to capture any context surrounding the word in question
  - Code for a single category of code at a time (i.e. code an entire document for all codes under super-code 'INFOSOUR' and then return to the beginning of the transcript to code for all codes under super-code 'ORGSIND')
  - Code segments of text into multiple codes, if appropriate (i.e. codes are not mutually exclusive)
  - Treat the super-code (e.g. INFOSOUR) as a bin to put text that should be under the broad category but may not fit within one of the sub-codes

After coding, return to this super-code to determine if additional sub-codes should be created (i.e. emergent categories of data per Corbin and Strauss)

Codebook:
- *RESOURCE – Mentions of resources that were helpful, or would have been helpful*
  – FINANC – Mentions of financial resources (e.g. FEMA aid, etc.)
  – TECH – Mentions of technical resources (e.g. GIS mapping, etc.)
  – NGO – Mentions of NGOs or faith-based organizations
  – VOLUN – Mentions of individual volunteers
  – PARTNER – Mentions of partnerships with other governments or NGOs
  – GOVT – Mentions of their own internal government resources

- *PROCESS – Mentions of the recovery process*
  – MEET – Mentions of meetings held with public or other groups
  – WEBINFO – Mentions of using the internet or social media to inform the public
  – COLLAB – Mentions of collaborations between groups or citizens
  – STKHLD – Mentions of stakeholders' opinions or actions
  – COALIT – Mentions of the formation of coalitions

- *ACTIONS – Mentions of specific actions taken by the community to recover*
  – FEES – Mentions of passing fees to pay for recovery
  – SHORT – Mentions of short-term projects (small repairs, etc.)
  – LONG – Mentions of long-term projects
  – POLITIC – Mentions of political actions

Appendix B. Codebook for documents

Coding instructions:
- Coders should read through the full transcript prior to beginning coding
- Coders should review codebook before coding
- Fill in the appropriate response into the correct column on the excel spreadsheet.

Q1. Community name
   1. Boulder
   2. Longmont
   3. Lyons
   4. Estes Park
   5. Loveland
   6. Evans
   7. Greeley
Q2. Document # (1, 2, 3...)
Q3. Name/title of document
Q4. Date of document
Q5. Who wrote the document? (Drop-down menu)
   1. Mayor
   2. City/Town Council
   3. City manager
   4. Government staff (general)
   5. Government staff—transportation
   6. Government staff—utilities (water, sewer, electricity)
   7. Government staff—planning, land use
   8. Government staff—economic development/business
   9. Government staff—historic preservation/art/culture
   10. Government staff—emergency response, fire
   11. Government staff—parks, open space
   12. Flood recovery working group/task force (i.e. made up of citizens, . . .

13. Businesses, staff, etc., formed for purpose of flood recovery)
14. FEMA
15. Federal agency (general)
16. State agency (general)
17. External consultant
18. University/Academic
19. NGO
20. Public/citizens
21. Other

Q6. Type of document (Drop-down menu)
1. Minutes from meeting
2. Agenda from meeting
3. Recovery goals/objectives/plans/guidelines/strategies
4. Public input/comment summary
5. Specific project report (e.g., creek restoration)
6. Alternative analysis
7. Scientific/technical report
8. Budget
9. Land use plan/map
10. Floodplain map
11. Other

Q6a. Type in OTHER type of document (Q6)

Q7. Primary topic of document (Drop-down menu)
1. Budget
2. Damage assessment
3. Debris removal
4. Waste water management (sewers, wwtp)
5. Drinking water
6. Electricity/Gas/Power utilities
7. Transportation
8. Creek restoration
9. Housing/residential
10. Historical preservation/art/culture
11. Businesses/economic development
12. Emergency response
13. Land use planning/zoning
14. Other

Q8. Secondary Topic (same list above)

Q9. Tertiary Topic (same list above)

Q10. Does the document summarize or mention a specific meeting? (Yes/no)
If no, stop coding document

Type in Community name and document # in columns 1 and 2

Q11. What is the name of the meeting?

Q11a. What type of meeting is discussed in the document? (Drop-down menu)
1. Internal community staff meeting (general)
2. City council/elected official meeting
3. Meeting with other communities staff/officials
4. Meeting with FEMA or other federal officials
5. Meeting with state officials
6. Water/Sewer board meeting
7. Economic development board meeting
8. Public meeting (primary purpose to engage broad public/public at large)
9. Recovery working group/task force meeting
10. Other

Q11b. Other (Q11)

Q11c. What were the dates of the meeting(s)?

Q11d. Was this meeting already coded in a previous document? If yes, type in document number and stop coding

Q11e. What was the primary topic of the meeting?

  1. Budget

  2. Damage assessment

  3. Debris removal

  4. Waste water management (sewers, wwtp)

  5. Drinking water

  6. Electricity/Gas/Power utilities

  7. Transportation

  8. Creek restoration

  9. Housing/residential

  10. Historical preservation/art/culture

  11. Businesses/economic development

  12. Emergency response

  13. Land use planning/zoning

  14. Other

Q11f. Who led/facilitated meeting?

  1. Government staff

  2. Elected government official

  3. State agency staff

  4. Federal agency staff

  5. Resident

  6. NGO

  7. Other

Q11g. Fill in Other led meeting (Q11f)

Q11h. Who attended the meeting? (list all that apply)

  1. Government staff

  2. Elected government official

  3. State agency staff

  4. Federal agency staff

  5. Residents

  6. NGO

  7. Other

Q11i. Fill in for Other from Q11h

Q12. Did public participation or input occur as part of meetings? (Yes/no)

If no, go to Q13

Q12a. How many community members (non-staff) were in attendance at the meeting?

Q12b. Describe mode of public participation

  1. Input collected via Internet form/town website

  2. Input collected via survey (email, phone, or mail)

  3. Unsolicited input from residents via emails, phone calls, letters

  4. Input from residents via social media, fb, twitter

  5. Resident input at meeting (eg., speaking at city council meeting)

  6. Input collected at public meeting (purpose of meeting to collect info)

  7. Deliberative/collaborative process of stakeholders, residents

  8. Other

[*if more than one is true, drop down a line in the spreadsheet and use drop down for additional participation types*]

Q12c. Fill in other from Q12b

Q13. Information dissemination: did the town disseminate information to the public as a part of the meeting? (Yes/no)

Q13a. What topic of information was disseminated?

  1. Utilities update (sewer, water, power)

  2. Transportation update (e.g., road closures)

  3. Temporary sheltering

  4. Housing information

  5. School information

  6. FEMA reimbursement

  7. Volunteers/volunteer opportunities

  8. Budget

9. Specific project update (e.g. Creek restoration project)
10. Land use plans
11. Floodplain maps
12. Flood risks
13. Other

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