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Exploring the social legacy of frequent wildfires: Organizational responses for community recovery following the 2018 Camp Fire

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ABSTRACT

The increased global frequency and scale of impactful and destructive wildfires has necessitated the reimagination of recovery assistance in affected communities. Unequal experience with and access to resources to support recovery mean that organizations operating at different scales may provide varying types of assistance after fire, particularly in rural areas. The US state of California has experienced several notable wildfire events in the past decade, including the 2018 Camp Fire that broke state and national records associated with the losses it caused. Interviews with 45 individuals involved in post-fire recovery after the Camp Fire are examined here using structuration theory to understand varied organizational responses across scales. Interviews focused on understanding how different organizations respond to wildfire disasters before examining the legacy that frequent wildfires have had on wildfire recovery response at local, state, and national scales. The rigidity of national and federal level organizations required local and state level organizations to rapidly adapt to support context-specific recovery needs. Local organizations accessed knowledge gathered during other recent wildfire disasters to navigate local impacts and needs. Without formal means to document perishable knowledge gathered during past wildfires, lessons learned may not be harnessed during future hazard events. Future recovery efforts after wildfire will benefit from proactive efforts to foster cohesion across responding organizations, opportunities to share and apply knowledge gathered through experiential learning, and predetermined methods for communicating how non-local responses should take local social contexts into consideration.

1. Introduction

Recent "unprecedented" wildfires and their associated social impacts have placed a greater emphasis on the importance of well-coordinated, resourceful, and adaptive post-fire disaster recovery efforts. However, rapid access to assistance, guidance, and resources to appropriately support immediate response and long-term recovery has proven challenging due to the increasing diversity and scale of impacts documented across affected communities after fire [1]. That heterogeneity is likely to vary further as wildfire losses occur beyond traditional geographic definitions of the wildland-urban interface – particularly in urban areas and ecosystems that historically have not seen fire [2]. Together, the diversification of fire impacts, landscapes burned, and evolving social contexts established through interactions between people and place over time require the reimagination of recovery response to keep up with changing post-fire conditions. Advancing understandings about organizations involved in post-fire recovery, including their structure, the ways in which they interact with each other across scales, and their adaptive capacity or ability to adjust to change is critical for

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streamlining effective post-fire assistance, particularly after large fires.

Access to, and implementation of, knowledge to inform recovery is unequal. As a result, understandings, experience, and resources to support community recovery are highly variable among organizations [3,4]. While some organizations are established to address the needs of impacted communities, other organizations – particularly those at the local level or in rural areas – may have no prior experience with disaster recovery and no clear means by which to access that knowledge [5,6]. These challenges may be compounded or alleviated by the adaptive capacity of an organization (and the individuals it is comprised of) both before, during, and after a fire event [7,8]. Identifying and implementing lessons learned after disaster has been documented as one useful pathway for improving adaptive capacity in post-fire contexts, particularly as actions taken prior to disaster events can shape post-fire recovery [9–11]. Memory and actions associated with past fire events may not become permanently incorporated into local and organizational culture, especially if time between fires is long, conflict emerges that prevents communication, or if no system is in place to support documentation of recovery processes.

The Camp Fire in Butte County, California, gained international attention in 2018 when it broke state records for structure loss and civilian fatalities. This article examines the role of learning and knowledge exchange within and between organizations involved in post-fire recovery after the Camp Fire across a range of scales and contexts, and the ability of organizations to adapt this knowledge to local contexts in Paradise, CA and the surrounding area. Interviews with 45 employees and volunteers from organizations involved in recovery after the Camp Fire are examined here using Giddens' [12] structuration theory to understand organizational capacity to access and adapt knowledge gathered from other recent fires in northern California. Few studies have been dedicated to understanding organizational efforts to aid fire-affected populations or the ways in which organizations interface with each other across scales to address local impacts. That information is a vital component in increasing adaptive capacity of both organizations and communities to effectively respond to and recovery from impactful wildfires. This research also explores some of the potential consequences of frequent fire disasters in the same region, and the effect it is having on knowledge exchange among organizations involved in implementing or supporting post-fire recovery efforts.

2. Literature review

2.1. Organizational responses to support wildfire recovery

Organizations involved in community recovery after wildfire differ across locations, types of impacts, and the scale of losses relative to population and resources. Assistance can be provided by both federal and non-federal entities. Federal support is often provided by the Federal Emergency Management Agency (FEMA) following a presidential disaster declaration and assessment of needs, and can include financial support for households, businesses, and local governments [13,14]. Non-federal assistance can consist of local or state governments, community-based organizations, non-profit charities and organizations, and volunteer organizations active in disaster (VOADs) [10,15]. These organizations operate across a range of scales, spanning local (e.g., community groups or churches), county (e.g., County Emergency Management), state, regional, and national (e.g., Red Cross) needs. National organizations often have local offices or state-sub groups (e.g., United Way of California). The kinds of assistance these organizations can provide varies widely too. Smith [9] categorizes them as funding, policy, or technical assistance. All three types of assistance are interrelated, meaning that a change in one may have consequences for another. A common critique of larger bureaucratic organizations and agencies involved in recovery is their "command and control" approach, characterized by inflexibility or delayed adaptation to address place-specific needs that restricts local-level capacity-building for disaster response [6,16].

When context-specific needs are overlooked or cannot be met by existing recovery organizations, particularly at those higher levels, local residents and professionals may "galvanize" to identify resources and actions to overcome these assistance gaps [6,17–19]. These emergent groups or organizations tend to surface once immediate response efforts begin to shift into recovery [17,20–22]. Larger or more formal organizational shortcomings may demand local organizational adaptation too; smaller or more specialized organizations who frequently interface with affected populations may rapidly repurpose their resources and activities to meet recovery requests placed upon them after disasters. Across both altruistic communities that come together after disaster and organizations that emerge to address context-specific needs, one core challenge is acquiring appropriate knowledge about recovery, then developing or re-tooling existing skillsets to provide effective assistance using that knowledge [18,23].

The effectiveness of organizations engaged in recovery – based, in part, on their ability to access and translate existing knowledge and practices from other disasters – can influence public support or perceptions of assistance [24]. Residents and professionals alike critiqued the FEMA assistance process after the Carlton Complex Fire in Washington State by suggesting that the assistance structure was not transparent, which consequently fostered perceptions of inconsistent or biased aid allocation after wildfire [20]. Other studies have documented stark differences in resident support for locally-based ("insider") organizations versus non-local ("outsider") organizations that often manifest due to distrust in government agencies or organizations that cannot demonstrate an understanding of local culture or community familiarity [25–27]. However, "insider" organizations may be overwhelmed during and after significant wildfire events, meaning that recovery may depend on the presence of "outsider" organizations with a greater capacity for response [4,16]. These studies highlight how absence of coordination or communication among organizations involved in recovery can foster long-lasting conflict, restricted access to resources, and distrust that can hinder recovery and create obstacles to assistance during subsequent hazard events.

Experiential learning (knowledge continuously gathered and applied in-situ) is critical to improving disaster recovery because it can streamline response and organization using learned successes from previous events [28,29]. The experiential learning cycle identifies five core phases for developing and applying experience-based knowledge: experiencing, reporting, reflecting generalizing, and applying. Disaster recovery occurs in fast-paced and often under-resourced environments, which makes "reporting" and

"reflecting" on successful processes and lessons learned for future disasters challenging [30]. One of the largest challenges to preserving knowledge developed through experiential learning after fires is the predominantly localized, intermittent nature of fire events that limits opportunities to "generalize" and effectively "apply" new knowledge. Disastrous fires may not be frequent enough to establish collective knowledge and disseminate it before momentum to promote change or improve future adaptation is lost [31]. Finding ways to document and disseminate this perishable knowledge after large or impactful wildfires through various platforms and programs has become increasingly sought-after as populations with little or no recent wildfire experience begin to seek information [5,32–34].

Reflections on recovery from other hazard events indicate clear value in the collaboration and coordination of organizations involved in recovery to overcome knowledge gaps [35–37]. However, studies often highlight hierarchical or inflexible structures of recovery among organizations at different scales [6,16,23]. Numerous efforts to promote the reporting, reflecting, and generalizing components of experiential learning about fire to encourage its application have emerged recently (e.g., the Burned Area Learning Network, Fire Adapted Communities Learning Network, prescribed fire training exchanges), but opportunities for knowledge exchange specifically related to social components of recovery are scarce. Informal knowledge exchange and implementation in post-fire environments remain under-researched, and it is unclear whether organizations operating at different scales or with different structures and purposes access and implement existing knowledge differently.

2.2. *Structuration theory as a lens for investigating wildfire recovery*

Some organizations have developed pronounced responses to disaster recovery that have become associated with their identify over time; for example, the Red Cross has developed a very formalized response to disaster by establishing and overseeing the operation of evacuation shelters. However, the roles of organizations and groups that emerge after disaster and the ways in which they rapidly evolve their efforts to align with local needs is less defined. Structuration theory [12] offers one framework for examining the variability of responses among both formal and informally organized groups across scales, and the extent to which they interact and exchange knowledge.

Structuration theory is concerned with two interacting components: agency and structure. Giddens [12] proposes that actors' (individuals and groups) capacity to act ("agency") are constrained by and reinforce the rules and resources that have been established within social systems to create "structure." This co-dependency between agency and structure within social systems is often referred to as the "duality of structure." Interactions between structure and agency create conditions for the establishment and communication of meanings, foster and reproduce power dynamics between individuals and groups, and define parameters for behavior across these interactions in social systems. Actors can perpetuate or modify structures through behaviors, actions, and interactions across different temporal and spatial scales. The capacity to act allows an agent to exert power over others that can increase or restrict their capacity, giving way to opportunities for hierarchical social structures.

Organizations that take action during and after fire may exercise their control through both rules and resources [38,39]. Resources can be categorized as either allocative (i.e., control over objects and resources) or authoritative (control over individuals or groups) in structuration theory. Organizations involved in recovery often may have access to finite or high-demand resources after fire such as food, shelter, or money to support affected populations. This provides those organizations with power at specific times and places within a social structure, particularly if the resources they possess are in high demand. This in turn can define or be defined by rules – the behaviors and actions that reinforce structure. Fire events can create windows of opportunity for certain individuals or groups to exert greater influence on local structures [40,41].

Giddens notes that individual and group agency can exist because of the establishment and implementation of knowledge developed in social interactions using shared norms and learned experience [42]. For organizations involved in post-fire recovery, access to and use of institutional knowledge is key to effective interactions within shared or overlapping structures. However, the ability of individuals or groups to adapt that knowledge to their own context or the broader structures they act within depends on their reflexivity. Reflexivity describes the ability of actors to consciously adapt their behaviors, norms, and actions to new contexts or circumstances [12]. Wildfires and other hazard events can create windows of opportunity for reflexivity, as Giddens explains that "agents routinely incorporate temporal and spatial features of encounters into processes of meaning constitution" (1984: p29; [39]). Increasing adaptive capacity or evolving actions to become better aligned with new environments or interactions by using and implementing knowledge in appropriate ways offers opportunities to improve mitigation, response, and recovery from wildfire within diverse social structures [38,43]. However, chronic reproduction of social structures by agents may limit reflexive behaviors that can change rules and resources for the better. Inability to adapt to new environments and contexts has been noted in several instances in both disaster response and natural resources management, and is often referred to as a "rigidity trap" [44,45]; the structure becomes such that an organization cannot break free or they do not even know that their actions are confined to the rigidity of structure.

Existing wildfire social science efforts have successfully used structuration theory to explore elements of post-fire social interactions. Carroll et al. [17] examined conflict and cohesion through this lens after the Rodeo-Chediski Fire, observing that the "duality of structure" drove conflict between local and federal responses. A repeat study several years later indicated that cohesive structures and underlying conflict remained [26]. Paveglio et al. [46] expanded this application of structuration theory and conflict around wildfire to better incorporate the role of local social contexts into structure, examining how institutional structures built and reinforced by incident command professionals clashed with local-level structure. Those interactions created a structural legacy that allowed conflict and distrust to become perpetuated within the local culture by shaping residents' agency years after the Columbia Complex Fire had occurred. The research presented here extends these efforts by applying structuration theory to look explicitly at the convergence of organizations to support community recovery across different scales after a large fire event.

Examination of recovery processes through structuration theory can provide valuable insights into social adaptation to fire. Actors

addressing disaster-driven change within structures can facilitate the creation of more resilient systems if they have the capacity, resources, and knowledge to design or modify approaches and norms across scales [8]. This reflexivity in turn can improve the resilience of communities and the ecological systems they reside within to processes like wildfire, facilitating a reduced likelihood of losses or impacts during future events [47]. Adaptation can occur due to both direct and indirect exposure to a hazard event; the latter may occur through access to, and application of, experiential knowledge gained by other actors and shared through formal and informal networks [43]. As a result, the process of adaptation to fire can occur across diverse spatial and temporal continuums, and apply to structural hierarchies and their associated symbolism [48–50]. Resilient, fire-adapted communities and organizations possess the capacity to learn and adjust to fire risk and impacts as a result of shared perspectives and resultant collective action [51].

The increasing frequency of large wildfires in northern California has created conducive conditions for experiential learning and knowledge transfer to promote social adaptation. The study presented here seeks to advance understandings of structure and organization in post-fire environments through the following research questions:

1. How do organizations involved in post-fire recovery access and utilize existing knowledge?
2. To what extent are organizations able to adapt to meet the needs of impacted communities after wildfire?
3. Are organizations operating at different scales interacting and coordinating knowledge after large wildfires?

3. Approach

3.1. Study area

Northern California has experienced frequent large, destructive wildfires over the past decade that have contributed to a complex regional context for post-fire recovery. Seven of the ten most destructive wildfires in recorded state history have occurred during or after 2015, including the 2015 Valley Fire in Lake County, the 2017 Tubbs Fire in Santa Rosa, and the 2018 Carr Fire near Redding [52]. A rich patchwork of post-fire social conditions has emerged as long-term recovery efforts persist in these and other areas affected by fire, making northern California well-suited for studying recovery efforts and knowledge transfer over the course of frequent wildfires.

The Camp Fire began on November 8th, 2018 and burned 153,336 acres of mixed conifer, chaparral, oak woodland and brush before being fully contained on November 25th [53]. The “Ridge” area of Butte County, CA, which includes the communities of Paradise, Magalia, Yankee Hill, and Concow, was most heavily affected. These areas include high numbers of elderly and retired residents and average household incomes below the Butte County median that stand in sharp contrast to nearby Chico, a rapidly growing city with higher incomes and younger residents (US Census Bureau 2019). Almost 19,000 structures were destroyed and 86 fatalities were reported, making it both the most destructive and the deadliest fire in state history [52,54]. A presidential disaster declaration was announced for the Camp Fire on November 12th, which provided opportunities for individual and public assistance through FEMA [55]. Recent studies of the Camp Fire highlight diverse impacts derived from pre-existing social and ecological conditions, including reduced educational and medical response capacity, displaced populations, infrastructure damage, and vegetation loss among other impacts [56–61]. Federal investigations concluded that the Camp Fire was caused by powerline failure on Pacific Gas and Electric property. A number of wildfires had burned in the Ridge area in the years leading up to the Camp Fire including the 2008 Humboldt Fire which destroyed 87 homes near Paradise, motivating revisions to town evacuation plans and increasing local interest in fire risk mitigation activities.

3.2. Methods

The author conducted 43 semi-structured interviews with a total of 45 individuals across Butte County in February and March of 2019, approximately three months after the Camp Fire. This timeframe is often identified as a period of transition from immediate or short-term to longer-term recovery in the disaster literature [62]. Semi-structured phone interviews were conducted with three key informants prior to fieldwork. Key informants are individuals with specific expertise, insights, or knowledge [63]. Informants – in this case, individuals with expertise related to Camp Fire recovery – were asked to provide insights into ongoing recovery, discuss broad challenges during initial recovery efforts, and identify core organizations and individuals involved in supporting those affected by the Camp Fire. Findings from these initial interviews informed minor modifications to the interview protocol and confirmed that initial theoretical sampling efforts were comprehensive.

Participants were identified through a combination of theoretical and snowball sampling. First, a list of organizations actively involved in recovery efforts following the Camp Fire were compiled using systematic internet searches, news reports, and social media. Identified organizations operated at different scales, providing a comprehensive range of perspectives on recovery and opportunities to understand how organizations are interacting across different jurisdictions and with varying resources and capacities. Local organizations are classified here as those who operate solely within Butte County and its communities, including local governments like the Town of Paradise and City of Chico and community organizations like rotary clubs and church groups. This definition of “local” aligns with other post-fire research (e.g., Refs. [17,40]. State-level organizations are those that operate across the entire state of California, and national organizations include federal government, large NGOs or VOADs that serve the entire United States. In some instances, organizations or interviewees were not easily categorizable by scale because they may operate across two or more states or counties, or because an interviewee might be affiliated with multiple organizations operating at different scales. Whenever possible, specific employees, volunteers, or representatives were identified from each organization who could be contacted directly to invite participation. This process is commonly referred to as theoretical sampling [64]. Upon completion of each interview, the participant was asked to recommend other individuals both internal and external to their organization that had insights into post-fire recovery efforts

in the area, a recruitment technique known as snowball sampling [65]. Finally, the author visited local recovery centers, offices, and community buildings to recruit additional participants, ensuring that opportunities had been created for participation by organization representatives at every level and scale.

Interviewees spanned a wide range of organizations as a result of this dual approach to sampling. Some were dedicated to disaster response, while others assisted in recovery due to necessity, proximity, access to resources, or impact. Organizations responding at the national, regional, and state level included both federal and state agency representatives, and wide-reaching VOADs like the Red Cross, United Way, Salvation Army, and Samaritan's Purse. Interviewees associated with these VOADs spanned national, state, and local offices within their organization. County-level organizations included Butte County government, environmentally focused groups like Fire Safe Councils, community safety organizations, and NGOs supporting local populations with specific needs such as housing, veteran wellbeing, and faith-based services. At the local level, interviewees typically were integrated with a greater diversity of organizations including the Town of Paradise, faith-based community organizations, community funds or foundations, school district staff, mental health support organizations, and local emergency service professionals. At both the county and local levels, many organizations became entwined in recovery because it impacted the individuals or groups they serve rather than because recovery was their core mission. This is not an exhaustive list of interviewee organizations, but demonstrates the diversity of backgrounds and resources affiliated with recovery assistance following the Camp Fire.

The author utilized a semi-structured interview protocol to explore the influence of past wildfires on organizational responses to the Camp Fire. Semi-structured interviews allow for opportunities to explore emergent themes within discussion [66]. Open-ended questions in the interview protocol focused on: (1) organizational response to the Camp Fire; (2) interactions between organizations involved in recovery; (3) experience with previous fires and their relevance to the Camp Fire; and (4) ongoing recovery efforts. Probing questions sought to understand how lessons learned from previous fires were implemented (where relevant), and how local contexts influenced organizational approaches to recovery. Data collection ended once theoretical saturation – the point at which the author no longer heard new findings and emergent themes had been fully developed – had been reached [64]. A small number of interviews were conducted by phone with interviewees who were not based in Butte County or the surrounding area given the broad geographic distribution of organizations. Interviews lasted between 20 min and 3 h, with an average length of 45 min.

The author also attended six community meetings during fieldwork. Each of these meetings focused on a different aspect of post-fire recovery, ranging from a small local committee meeting to a long-term community planning meeting attended by more than 500 residents. The author took detailed notes at each meeting and used these events to identify other potential interviewees. Meetings allowed for confirmation that emergent themes were representative of widespread recovery challenges after the Camp Fire.

Interviews were recorded with participant consent. In three instances where participants declined to be recorded, the author took handwritten notes. Recordings were transcribed verbatim before being analyzed using qualitative analysis software NVivo 12 [67]. Themes were identified by the author through several iterative rounds of increasingly restrictive coding that built on emergent themes noted during fieldwork [68]. This approach involved a combination of analytic induction and thematic analysis to further develop overarching themes [69]. The first round involved descriptive coding, followed by a round of coding for concepts specific to structuration theory. A third round of analysis allowed for the development of thematic codes. Finally, representative quotes were selected for each theme.

4. Results

Impacts and losses from the Camp Fire compounded pre-existing social inequalities in Ridge-area communities. The intersection of post-fire conditions with limited community resources resulted in unique post-fire conditions that many organizations described as a core challenge to their response efforts, specifically because the scale and rural nature of the Camp Fire appeared to be unlike other recent wildfire disasters in northern California. A community-level organization interviewee explained:

> The magnitude of this, and the social implications of this, seem of a completely different magnitude than what was experienced with the Tubbs Fire or with the Mendo[cino] Fires … You don't have the level of poverty that we had in Paradise. They're incommensurate in some respects.

Interviewees described the lower income and resource access in Paradise and other Ridge communities as a product of growing cost of living in Chico; many had been pushed out of more urban areas as housing demand grew and gentrification became deep-rooted. Working to address limited resources and household resilience in this rural post-fire context, in addition to the scale of losses from the Camp Fire, revealed both the rigidity or reflexivity of organizational response across scales.

4.1. Characterizing responses across organizational scales

Substantial differences in approaches to post-fire recovery assistance emerged immediately across organizations operating at different scales. Federal and national-level interviewees described systematic responses to the Camp Fire that had been informed by internal frameworks and protocols honed over the course of many past disasters in California and beyond, including Hurricane Katrina and other destructive weather events predominantly on the East Coast. This structure benefitted interviewees by allowing them to exchange knowledge across existing internal networks, feeding into after-action reviews that enabled these larger organizations to further refine future responses. This internal structure for response and evaluation meant that most interviewees from national-level organizations felt their response was improving as a result of northern California's frequent fires. High internal structure and interconnectivity across different offices or subsections of national organizations afforded these interviewees access to resources across a vast geographic area. That included access to information on which resources might be most in demand, connections to external organizations who could provide assistance, and the opportunity to expand internal capacity by asking employees from other

geographic locations to provide oversight or support. One employee from a national NGO explained:

> I just put out a phone call and had trucks rolling from Reno, Eureka, Santa Rosa, and Sacramento within 24 hours with supplies. So, you have to have that outside connection to get things in.

As a result, national-level organizations' approaches appeared to vary very little over different fire events in northern California; responses were altered to meet the contexts of different hazard events and extents but not necessarily the social diversity or contexts of the populations they were assisting. Interviewees from organizations operating at smaller scales described several instances where oversight of local context produced conflict and exacerbated distrust towards non-local organizations by both local organizations and residents. This was largely a consequence communication issues, including a perceived absence of opportunities for local organizations to provide feedback or guidance on what was needed in Ridge communities, and the prioritization of local buildings and spaces for extra-local organizations to set up their operations preventing their use as classrooms for local schools whose buildings had been damaged or destroyed. One state-level NGO employee shared an example:

> Literally, the [national-level organization] representatives and the [local-level organization] representatives got in such a huge argument that they had to call the police in Butte County. And that stems from long-term resentments in that area … You kind of have to have an understanding of the community that you're moving into in that regard.

Sub-national organization interviewees described the rigidity of national-level organizations' responses as difficult to understand; many believed those larger operations had the capacity and resources to accomplish more but were not willing to expand or adapt their efforts to meet place-specific needs. A multi-county VOAD employee summarized:

> Red Cross, Salvation Army, Catholic Charities, the strength of those groups can really help communicate and organize a little more. We need help, aside from just [those organizations] saying, "well, this is what we're doing."

National-level interviewees described their approaches as tailored to immediate response and early phases of recovery, which they saw as fairly consistent across disasters. One interviewee from a national NGO explained: "our goal is to stop the emergency, to make sure they are well enough to move forward into whatever their new normal looks like." They sought to stabilize conditions to hand off longer-term efforts to local organizations. However, according to local-level interviewees, these conversations were not necessarily coupled with considerations of how that hand-off might occur, and whether there was local capacity to support this relinquishing of responsibility. That resulted in local organizations describing unexpected rises in the populations they were serving when national-level organizations withdrew from the area, without enough time to prepare for that increased demand in assistance.

Consequently, local organizations found that requests for assistance following the Camp Fire far exceeded local capacity to respond. Few local-level organizations had experience with disaster recovery, although some did reference the 2017 Oroville Spillway incident and associated evacuations in Butte County as advancing preparation for future emergencies, specifically regarding evacuation and relocation of large populations. In most instances, organizations were absorbed into recovery efforts by the needs of the populations they normally served (e.g., local church groups were now running resource centers with food, water, and basic items), or the scope of their existing work expanded drastically overnight (e.g., charities working to address local homelessness became overwhelmed with thousands of requests). In many cases, local organizations found themselves burdened with navigating federal assistance programs on behalf of their communities without a clear understanding of where to begin due to their lack of familiarity with recovery. Constituents or members sought local organizations' assistance with navigating insurance claims or federal assistance, but organizations were often unsure of how to begin providing that support. This knowledge gap also included addressing larger level needs such as FEMA's Public Assistance program, as one Paradise official explained:

> When it's this big, you'll hear things like, "well call CalOES [California Governor's Office of Emergency Services]." Well, call who? CalOES is not one person, it's thousands. Call FEMA, who? Who, who's the person? I think that's been the biggest problem, is sometimes you don't know who to talk to.

This lack of capacity and familiarity with recovery meant that local responses also were constrained by larger level efforts – particularly heavily structured federal government. A perceived lack of clarity regarding the parameters of federal financial assistance, particularly public assistance from FEMA, left many Town of Paradise and Butte County employees uncertain about the extent to which they could embark on rebuilding efforts for local infrastructure. A local government employee summarized:

> Like it or not, we're under the thumb of FEMA because we can't fix the system on our own. We have to have FEMA's help, right? We don't have millions and millions and millions of dollars in our own pocket to go "oh, well, we'll do everything ourselves" or even a way to earn that millions of dollars. We're broke. We're flat broke. So, we're under the thumb of FEMA to say "here's our plan. Here's how it is. Do you agree with it? And are you going to reimburse us?" And if they say yes or no, that's going to be the focus of how we go about it.

4.2. Overcoming recovery knowledge gaps

Local-level interviewees identified that lack of experience or knowledge about post-fire environments and both federal and non-federal recovery processes and resources limited the impact their assistance had on affected communities. One Butte County employee explained: "We're finding the gap in how the government works. Government's not designed to do everything." To overcome these gaps, many community- and county-level organizations sought or were extended opportunities to access post-fire recovery knowledge through interaction with other individuals, organizations, or communities that had recently responded to disaster. Thematic analysis of interview data allowed these opportunities for knowledge acquisition to be categorized as: (1) interactions with organizations or individuals who play similar roles; (2) interactions with communities or recovery organizations affected by similar

fires; or (3) communities or recovery organizations affected by other disasters that caused similar impacts.

Local organization interviewees most frequently described communicating with others who held a similar position as them in other areas recently affected by wildfire. However, who reached out to who first – the person working on Camp Fire recovery or the person who had worked on a fire elsewhere – appeared to vary based on whether they already knew each other or not. In some cases, interviewees described reaching out to counterparts for advice based on their own assessment of how Camp Fire impacts aligned with other fires, whereas others were contacted without prompting by their counterparts. The latter was most common when both individuals already had a working relationship prior to the Camp Fire. A City of Chico employee described their experience:

> The [position title] of Santa Rosa shot me a text and he said "hey, hey [name], how you doing? And do you need some help?" And I said "fine. Yes." and so he said "okay, I'm on my way" … the experience that he had with the fire a little over a year before this one hit in Santa Rosa proved to help us, be benefitted to knowing: what do we really need to do to hopefully mitigate the impacts of what we were going to be experiencing?

These counterparts were able to provide input and advice that took into account local context and capacity based on their familiarity with northern California. They often acted as advisors for interviewees in this study, making suggestions of things to document, potential solutions to issues that they had previously experienced, and recommending resources to support local response.

Interest in knowledge and learning specific to wildfire events drove connections between affected communities, predominantly within northern California. Exchanges regarding recovery efforts following the Tubbs and Carr Fires were most common. A Town of Paradise employee described:

> We didn't know the ins and outs of Santa Rosa until we actually contacted them, right? "What did you guys go through?" … only 10% of their district burnt and 90% survived, so there's differences there. We're taking an example of a very small portion of their community and using it and we're spreading that over our entire community.

These interactions and shared knowledge were widely recognized as having important but limited value in the context of the Camp Fire, given the unusual extent of fire impacts and losses and the specificity of some challenges such as Paradise's water irrigation systems. That led some individuals to seek out other advice from responding organizations after other disasters that had caused damage or destruction at similar scales or levels of intensity, including the Joplin Tornado, Hurricane Katrina, and other historically impactful events like the 1889 Johnstown flood.

The sum of these three different sources of knowledge transfer drew consistent recognition that no two fire events caused the same impacts, or occurred within the same social contexts. One Californian VOAD interviewee summarized how that affected Camp Fire reponse:

> It's hard to know what to do, because no one's done it. We find ourselves kind of writing a playbook. We're becoming, unfortunately, the experiment. How do you manage a city that has nothing?

4.3. Adapting to improve local recovery efforts

Local-level interviewees explained that the limited transferability of knowledge from the three sources outlined above required them to independently adapt their efforts to best assist Ridge-area communities. For local and state organizations that already had experience responding to fires, adaptation strategies focused on understanding place-specific needs and accessing resources that would support capacity building and establishment of interorganizational relationships. One interviewee from a multi-county charity explained how successfully expanding their organization's scope to include the Camp Fire required them to first take a step back:

> A challenge for us is to just really commit to building trust in a new community, to understanding the complexities of the issues that existed before this fire happened and are now exacerbated due to displacement and all the other things that a fire of this magnitude affects.

Organizations working to establish long-term assistance programs on the Ridge also tailored their responses by pairing with other organizations to form a unified approach, hiring Ridge-area residents who were already established within impacted communities, and contracting with consultants who had recovery experience among other approaches.

For local organizations with no prior recovery experience, this meant starting from the beginning as one interviewee from a local faith-based community organization described:

> Several things emerged right away. One of them is: we have no idea what we're doing. There is a certain national VOAD boilerplate. I tried to read it - I fell asleep every time. It was just, I'm not sure exactly from that what I was supposed to do. And as we gathered, we became the table, the place where others who didn't know where they fit in recovery came.

Employees and volunteers at local-level organizations described how they increasing looked to one another for examples and ideas regarding new approaches to develop community-specific needs as recovery progressed. That interest in Camp Fire-specific knowledge exchange was echoed by interviewees from organizations at all scales. However, while there was widespread recognition that recovery efforts needed to be coordinated and integrated efficiently to provide effective assistance, interviewees felt that there wasn't a clear roadmap or set of instructions on how to establish collaborative structures to achieve this. One multi-county NGO interviewee explained:

> In our society and our culture, collaboration is a buzzword, something that people think "Oh, that's a good thing to do." But we don't know how to do that well … in a disaster like this, especially when things are heightened, you know, frustration, stress, everybody's stretched beyond what they can do. That doesn't foster a great environment to work together either. So, all the

> more reason for communities to [proactively] develop resiliency, to really have real tangible tools that they could use in relationships, in communities to really start working together.

Interviewees identified a perceived absence of leadership as the central barrier to effective collaboration across local, regional, state, and national scales. While organizations operating at the same scale tended to work well together and made marked efforts to share information, many described interactions between local and national level organizations as lacking transparency or clarity. This restricted assistance for affected populations in the initial stages of response and recovery, leading to unnecessary duplication of resources in some instances and missed opportunities for collaboration in others. Local, state, and national level organizations appeared to indicate that it was each other's responsibility to establish a leadership role, as one federal agency employee noted:

> Nobody wants to take the leadership over [for Camp Fire recovery] … "we'll take charge, but it'll be garbage." Nobody [at the local level] wants to do that. Nobody really wants to do that job. And CalOES, I guess it's kind of the same. They're like, "we need to wait for the town [Paradise] to say we're going to do that."

Many local-level interviewees originally believed that FEMA would play a larger role in connecting recovery efforts together across the impacted area by assuming leadership upon arrival. Disappointment towards federal response left state-level organizations tasked with navigating interactions between local needs and federal-level structure instead. However, these state-level mediators were also restricted by federal structures, as a local government interviewee summarized:

> They've [CalOES] embedded people, they give you the resources, they answer your questions, but they are under the same thing as we are. They're having to deal with FEMA to make sure that FEMA is going to accept their, whatever direction they're giving to you, because at the end of the day FEMA holds the biggest pocket.

Non-governmental interviewees indicated that they thought state agencies like CalOES or CALFIRE (California Department of Forestry and Fire Protection) could effectively assume leadership roles in future fires given their perceived success spanning scales during the Camp Fire. However, some recognized that this might be easier said than done. A federal agency employee explained: "there doesn't seem to be one [central] person, because there really can't be – it's so fragmented, and it's so complex." This drive for unity across scales ultimately culminated in the creation of the Camp Fire Long Term Recovery Group, which gathered more than 100 representatives from organizations involved in recovery.

4.4. The legacy of frequent wildfires on recovery

California-based interviewees described how ongoing recovery from past fires, combined with the growing frequency and scale of impacts from wildfires, had placed pressure on state- and county-level organizations whose capacity to respond was increasingly stretched thin. An interviewee from a multi-county NGO that had responded to several recent fires summarized:

> In terms of Thomas, in terms of the Mendocino Complex Fire which we did respond to in 2017, we're still seeing requests come in for funding. So, something I am concerned about is kind of the frequency with which these [fires] are happening and the overlaying of need … it goes back to that issue of capacity building in general. Operating where we need to be simultaneously building up capacity so that future response is thoughtful and not just this avalanche effect of drying resources and time out of something that's already pretty exhausted.

That growing frequency with which recovery assistance was needed was compounded by a perceived inability for lessons learned to become translated into state-level policy change in time for it to benefit communities before the next fire. During a conversation about whether policy change could improve future recovery efforts, one state-level NGO interviewee shared:

> We just can't learn fast. We can't adapt fast enough. And it's gonna be tough. It's been consistent each year for the last few years. We've had residential areas catching on fire. And it's just, it's been bad. Not enough substantial change has happened to prevent that from happening in the future.

One compounding issue many interviewees identified for both productive policy change and local disaster management was a distinct lack of documentation about approaches and lessons learned by local-level organizations during recent fires. Without timely documentation and incorporation of perishable post-fire recovery knowledge into organizational frameworks or guidance documents, some worried that information would become permanently lost. One Californian NGO interviewee explained:

> Each thing that happens, each incident, we learn a little bit more from and we can look back to the past. And right now, I'd say it's only institutional knowledge that would allow for us to continue with the lessons learned. There's a long period of time where there weren't any fires or fires that are impacting [us], you know. I think that knowledge could be lost pretty easily.

Fear of depleting capacity both in recovery response and ability to document perishable knowledge, paired with the inflexibility of policy change, fueled conversations about how to preserve and apply knowledge gathered through experiential learning from the Camp Fire recovery. Interviewees consistently expressed interest in identifying ways to minimize losses and flatten learning curves for future organizations involved in wildfire recovery by documenting their own experiences. However, few were able to provide concrete ideas of what those preservation efforts would entail at this early stage in recovery. Instead, many locally-based interviewees in Paradise, Chico, and the surrounding area emphasized a broader temporal view of the pre-existing local contexts that existed before the Camp Fire began, and the need to focus on proactive mitigation activities at larger scales for larger-than-expected fire events:

> It's gonna drain the county, so much of their energy focusing, having to deal with this. Are they going to be able to get ahead of the fire cycle for the next round, when so much of their leadership is having to deal with this disaster? If we would have put that volume of energy into prevention and planning, we would have been in such a different place.

These concerns culminated in a shared willingness among local organizations to reciprocate the support of organizations and

individuals who shared their knowledge from previous fires by pushing for a more proactive effort to document perishable knowledge and establishing efforts to guide non-local organizations through considerations for local social contexts.

5. Discussion

> No matter what we learn from each one of these fires, we're finding out that there's a portion of the wheel that we have to reinvent every time because of the uniqueness of the communities these [wildfires] are happening in … [but] The Camp Fire completely reinvented the wheel. The sheer speed and the mass destruction of that thing. We were completely overwhelmed.
>
> *– State-level NGO interviewee.*

The scale and scope of impacts associated with the Camp Fire motivated diverse organizations to provide recovery assistance, regardless of whether disaster response and recovery was their central mission or an emergent focus driven by demand or necessity. This study sought to understand whether organizations varied in their response to the Camp Fire, and the extent to which they interacted with one another across organizational scales. Findings inform and extend three key areas of the wildfire social science and disaster recovery literature. First, they provide insights into how recovery organizations across scales respond to unique local contexts associated with fire, a topic that is rarely the focus of existing literature. National- and state-level organizations adapted the least to the specific needs of Ridge communities. Second, findings demonstrate how the increasing frequency with which destructive fires are occurring can present both challenges and opportunities to recovery and preparation for subsequent disasters. Finally, the discussion below expands upon existing wildfire-focused applications of structuration theory to examine post-fire recovery from an organizational perspective. This study indicates that locally-based organizations – who often have the lowest adaptive capacity due to fire impacts – face the greatest pressure to evolve their efforts to provide recovery assistance to affected communities.

Giddens' [12] structuration theory can help interpret the varied responses of organizations operating at differing scales. The rigidity with which national-level organizations (e.g., Red Cross, FEMA) operate indicates that they house and reproduce well-defined recovery responses with such rigor that it is now difficult for actors within these structures to adapt their actions beyond those rules and norms. That rigidity is consistent with other studies of national- and federal-level recovery efforts that find bureaucratic responses exhibit inflexibility and an inability or unwillingness to adapt to local needs, typically according to locally-based study participants [6,16]. The "duality of structure" that sustained those large organizations drove both the characterization of their distinct responses and restricted reflexive responses to varied social impacts across disasters. That inflexibility formed the basis for conflict across organizational scales through two means: first, a perceived unwillingness to understand local contexts, and second, a belief that these larger organizations had the capacity to expand their scope to diversify their responses but seemingly expressed no interest in doing so. This division aligns with "insider" and "outsider" group dynamics documented as a factor causing conflict in rural wildfire recovery elsewhere [17,20,26].

Rules and resources of national-level organizations required the establishment and reproduction of hierarchical power dynamics among recovery organizations. This dynamic was most frequently exposed in discussions about FEMA. FEMA's resources at early stages in the recovery process were both allocative and authoritative; they had access to extensive funding that was in high demand on the Ridge, but also the power to withhold or provide that financial support as they saw fit. The perceived ambiguity of FEMA's assistance restricted some local organizations' ability to act and support recovery within their community out of fear for acting outside of those unclear federal structures. The self-regulation that local organizations imposed on themselves as a result of FEMA's ambiguous structure has been identified in local-federal dynamics for other hazards (e.g., Ref. [70]. The restriction of local agency by unfamiliar federal structures has the potential to cause mal-adaptation or delay critical recovery activities by preventing local implementation of necessary recovery approaches out of concern that it might not align with federal reimbursement structures. Additionally, it may prevent the development of innovative approaches that can better complement local contexts as local organizations are forced to "play by the rules" in order to receive federal recovery assistance. For example, alleviation of ambiguity around FEMA disaster assistance could allow local organizations to prioritize infrastructure repairs in an order that attends to community need rather than by the likelihood of federal reimbursement. The rigidity trap that high level structures have created for recovery may prevent opportunities for beneficial adaptation and incorporation of new approaches into state or national standards that can benefit other disaster-affected areas [43–45].

Rigidity traps in national-level organizations motivated and necessitated adaptation among local and state-level organizations to support context-specific needs. That "galvanization" of local groups has been documented in numerous existing studies of both recovery and mitigation for wildfire [17,19,26,71,72]. Findings here expand upon that body of knowledge by illustrating the disconnects that efforts to galvanize must overcome. First and foremost, access to knowledge that can elevate locally-driven approaches must be established [73,74]. That may include information about the most vulnerable populations, trusted organizations or community leaders, and identification of places or values (e.g., the Honey Run Covered Bridge in Butte Creek or the welcome sign for Paradise) that resonate with residents that should receive additional consideration to protect community wellbeing and sense of place during recovery. This in turn can be used to inform community events, creation and delegation of long-term recovery tasks, and support communication channels between fire survivors to open clear lines to unquantifiable recovery such as place attachment. Interviewees also described accessing knowledge through individuals and groups who had responded to recent wildfires or other impactful disasters; however, there were limits to the transferability of that knowledge due to both the extreme nature of the Camp Fire's impacts and the unique local context it occurred within. Local organizations operationalized their own reflexivity to assess new mutual knowledge and determine the extent to which it was relevant to Ridge-area communities, given the scale mismatch associated with impacts.

Giddens argued that human agency is created by stocks of knowledge within structures (1984). The facilitation of new knowledge

between organizations involved in recovery after the Camp Fire operationalized organizational reflexivity, expanding structural rules and resources to overcome challenges and broaden their capacity to respond to local needs. That implementation of new knowledge into action or "praxis" indicates an informal continuation of experiential learning – specifically, reporting, reflecting and generalizing in the experiential learning cycle – that can protect perishable knowledge gained after wildfires and encourage its future application. This allowed for more tailored recovery efforts and the establishment of social networks that can provide guidance on how to navigate new or external organizational structures. Future applications may include more structured knowledge exchange at the outset of impactful fire events, development of more proactive partnerships between like-kind positions across agencies and governments, and the development of documents or databases that incorporate more qualitative or value-based community data.

Knowledge exchange between both individuals and groups engaged in recovery aligns with existing research on organizational learning and structuration theory, highlighting the duality of structure between actors [75]. Formalized exchange of knowledge gathered through experiential learning have become core tenets of wildfire adaptation in recent years, with the establishment of structured programs and efforts like the Fire Adapted Communities Learning Network and the Joint Fire Science Program Consortia [43,51,76]; however, no formal program exists solely for exchanging information about *social* components of post-fire recovery. This study indicates that there is value to both informal and formal knowledge exchange, but the establishment of a formalized protocol or platform for reporting, reflecting, and generalizing about local approaches to recovery could offer a fast-track route for like-kind individuals, communities or organizations to connect and share knowledge gathered during experiential learning. This need is reflected in recent calls for systematic documentation of social data regarding local contexts and fire [1,77] and intersects with national calls for "shared responsibility" for fire adaptation between communities, governments, agencies, and other affected parties [78].

Findings from this study reveal a clear disconnect between federal or national organizations and local and state-level organizations. At smaller scales, this meant unfamiliarity and uncertainty with larger-scale processes such as FEMA assistance, while at larger scales this translated to an inability to incorporate and include considerations of local contexts. This culminated in a perceived absence of leadership for recovery by interviewees across all scales and organizations. Descriptions of leadership needs indicate that individuals or organizations familiar with diverse organizational structures, rules, and resources present in recovery would be well positioned to fill this role, and in California specifically, that facilitation would be trusted across scales if it were embedded within a state agency that has already gained local support (e.g., CalOES or CALFIRE). Previous studies have found that when a leader is not identified in the early stages of response and recovery, this responsibility is often assumed by a responding VOAD prior to the establishment of long-term recovery groups or organizations [79]. However, VOADs rarely remain on-site for the duration of long-term recovery, creating issues associated with continuity in recovery communication and assistance as well as necessitating well-planned handoffs upon that VOAD's departure. The ability of national or state organizations to commit to leadership oversight across multiple temporal phases of disaster recovery was highly sought-after by locally-based interviewees, but many recognized the challenges associated with that level of commitment.

Calls for individuals or organizations who can interpret and respond to the diverse organizational structures present throughout various temporal phases of recovery mirror current efforts by some states and collaborative groups to delegate such positions for wildfire risk reduction. Individuals in those positions – sometimes referred to as boundary spanners, spark plugs, community leaders, or navigators – are in high demand but face particular challenges for post-fire response. Those who fill these roles before a fire may not be the same individuals who assume roles translating needs and information across different groups after a fire. Interviewees indicated that any such individual or organization should be intimately familiar with the local contexts of the area they are working in or at least able to identify the right individuals or organizations to connect with to understand those contexts. That included understanding basic social differences between populations (e.g., residents in Paradise versus Concow) and their varied access to existing resources before and after fires. This would require position holders to either be locally based, or to have a protocol for rapidly assessing community contexts immediately upon arrival in a way that not only considers current conditions, but also the events and interactions in the years leading up to the event that fostered current community identity. In some instances, positions have been created within local government to oversee these needs (e.g., recovery coordinators, see Mockrin et al. [80], but this is likely only feasible for wealthier or resource-abundant municipalities rather than rural and unincorporated areas. One solution may be the formation of groups or identification of community representatives who can clearly articulate the social context and history of their community to external recovery organizations. Such efforts would help translate local contexts to non-local organizations to better ensure that specific needs and conditions are incorporated within more structured approaches to recovery response [27,77,81].

A consistent theme among interviewees was a shared belief that the Camp Fire exceeded all previously held understandings of the extent of damage that wildfires could produce. That unfamiliarity led to uncertainty about how to provide response and recovery assistance in the initial days following the fire. Giddens refers to this as a disruption of "ontological security" – an occurrence that exceeds individual or collective understandings of the ways in which social and natural environments operate [12,25,82]. That disruption impaired the ability of some organizations to transfer knowledge gathered from other sources regarding previous wildfires and disasters, particularly in instances where the type of impact was similar (e.g., structure loss and water contamination after the Tubbs Fire) but the scale of that impact varied substantially. Difficulty identifying actionable approaches regarding how to adjust or "scale up" that information to new and unfamiliar post-fire contexts led to an underlying feeling of isolation as interviewees across organizational scales explored new frontiers in extreme fire loss. Organizations responding to the Camp Fire are now uniquely positioned to inform response to extensive destruction and loss of life for future fires as a result of experiential learning gathered during translation of knowledge across scales of loss.

The frequency with which wildfires are impacting Californian communities has proven to be both a help and a hindrance for adaptive approaches to advance recovery assistance in this study. Accessing knowledge gathered by other organizations involved in recovery within northern California via experiential learning created opportunities to capitalize on a fruitful learning environment.

However, interviewees from organizations at the state and multi-county level responding to multiple fires described their resources as spread thin as the growing concurrent demands for recovery assistance continued. Recovery after a disaster has no defined end point, which has resulted in overlapping long-term recovery responses to different fires in California recently [30,83]. Studies of recovery from other kinds of hazard events indicate that repeated disasters or near misses can lead to a higher density of coordination efforts that can subsequently foster collaborative capacity to respond [84]. Establishing mutual knowledge about wildfire will require concerted efforts to not only share different types of knowledge across scales (e.g., how federal agencies operate, how to prioritize needs of socially diverse disaster survivors), but also tools and techniques for facilitating reflexivity within diverse social contexts. Previous research on collaborative learning in fire recovery and planning can inform the initial structure of such collaborations to reduce conflict and improve representation of local contexts [32,85]. This can support more cohesive thinking about social and ecological systems recovery at landscape scales required for large fires like the Camp Fire.

The use of structuration theory to examine diversity and reflexivity of organizational responses to recovery highlights the importance of adaptive approaches to support context-specific needs. The heterogeneity of organizational responses overlaid on landscapes that are home to socially-diverse communities documented in existing wildfire social science (e.g., Refs. [86,87] demand versatile and adaptive recovery assistance after large fires. Diversity in organizational response across scales as documented after the Camp Fire is a strength, but can become more effective with collaboration to facilitate a more cohesive response. That collaboration is limited by the complexity of coordinating across organizations in a productive and effective way, particularly for local organizations and groups that address underserved populations; structuring post-fire recovery collaboration to address exacerbated inequities remains a critical consideration following future fires. While the reflexivity documented in local organizations after the Camp Fire indicate the value of adaptation for addressing local needs, it is important to note that this study focuses on organizational structure, knowledge, and interaction in a largely Californian context. Although findings here are likely of relevance to other locales, the "regionality" or diversity of people, places, and structures may limit the transferability of lessons learned following the Camp Fire [12].

6. Conclusion

The legacy of frequent wildfire events in northern California has exposed organizational challenges across scales that became exacerbated during recovery following the Camp Fire. Though national-level organizations have greater access to resources that could expand their adaptive capacity and support community resilience, more nuanced and reflexive responses fell to local organizations whose capacity was severely reduced by the fire. Recovery workers therefore seek out other like-kind individuals, organizations, and communities with similar structures and agency when they find both their understandings and actions restricted by rigidity traps produced and reinforced within national and federal organizations. Accessing knowledge gathered through experiential learning to facilitate action became central to operationalizing recovery efforts at the local level. This study indicates an urgent need for better incorporation of local contexts into national- and state-level organizations' responses to increase cohesion between organizations, streamline recovery assistance, and minimize conflict during future fires. Moving forward, cohesive efforts to both address place-specific wildfire recovery and document perishable knowledge for future use are critical to improve community recovery to fire across multiple scales.

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