

Mobile Home Parks and Disasters: Understanding Risk to the Third Housing Type in the United States

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Abstract: Research on affordable housing and disasters in the United States largely focuses on owned and rented housing, the nation's two most common housing tenures. Researchers have largely overlooked mobile home parks (MHPs), a third housing type that is home to 2.7 million households. Mobile home parks are characterized by their private ownership, stigmatization in popular culture and by local governance institutions, and unique tenure arrangement, in which residents own their individual homes but rent the land underneath. Existing studies have narrowly focused on the physical vulnerability of mobile home units and, to a lesser extent, the sociodemographic characteristics of residents. The interactions between MHPs and the environmental, social, and regulatory contexts of disasters remain largely unexplored. To holistically examine the factors that interact to produce disaster risk (exposure and vulnerability) for residents living in MHPs and assess whether parks are uniquely at risk compared to other housing types, an exploratory case study of the 2013 Colorado flood is presented. The central research question here is as follows: What characteristics structured disaster risk for MHP residents before and after the 2013 flood? Six MHPs located in 3 flood-affected communities, drawing on (1) surveys of 101 households whose homes were significantly damaged or destroyed by the 2013 floods, including 44 households living in MHPs; (2) semistructured interviews with 21 key informants who were active in the recovery; (3) observations at dozens of housing recovery-related meetings and events; and (4) analysis of recovery plans and government documents. Five mechanisms of exposure and vulnerability are revealed that together describe how MHPs and their residents were uniquely at risk to the disaster. The findings of this study may be summarized as follows: (1) MHPs were exposed to flooding at a higher rate than housing generally, (2) MHPs spatially concentrated socially vulnerable households, (3) MHPs and their residents were stigmatized by local governance before and after the disaster, (4) was a barrier to recovery, and (5) postdisaster recovery policies and plans disadvantaged MHPs and their residents. The article concludes by describing the importance of MHPs to community resilience and suggesting several avenues for future research. DOI: 10.1061/(ASCE)NH.1527-6996.0000357. © 2020 American Society of Civil Engineers.

Introduction: Mobile Home Parks and Disasters

Affordable housing is an important contributor to household and community resilience to natural hazards and disasters (Bosher 2008; Haigh and Amaratunga 2010; Comerio 2014; Keenan et al. 2018). For low-income and socially vulnerable households, high-quality affordable housing has positive influences on health, education, economic opportunities, and safety, which reduce vulnerability to disaster (Golant et al. 2010; Comey et al. 2012; Newman and Holupka 2014; Anderson et al. 2002). For communities, housing that is safe and affordable to a diverse population has long-term positive effects on economic and social mobility (Pendall and Hedman 2015). Access to affordable housing also allows individuals and groups to build social capital networks that they drawn upon during times of crisis (Aldrich and Meyer 2015). Housing affordability has long challenged households with low incomes and is increasingly challenging for those with moderate incomes (Mueller and Tighe 2007; Vale et al. 2014; Charette et al 2015).

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Studies have shown that affordable housing shortages can force households with low incomes to live in more physically vulnerable places or in overcrowded or dangerous conditions (Tierney 2006). During disasters, affordable housing tends to suffer disproportionate damage because of its location in hazardous areas or insufficient investments in hazard mitigation, and restoring affordable housing is often slow and challenging during recovery (Bolin 1985; Bolin and Stanford 1991; Peacock and Girard 1997; Peacock et al. 2007; Zhang and Peacock 2009; Highfield et al. 2014; Sapat and Esnard 2016).

This paper examines the vulnerability of mobile home parks (MHPs), a crucial but understudied component of the US affordable housing supply. Research on housing and disasters in the United States has focused almost entirely on owned and rented housing, the nation's two most common tenure arrangements, with most attention paid to single-family, owner-occupied housing. Scholars have largely overlooked MHPs, a third tenure type that is prevalent in communities across the country. MHPs are home to nearly 2.7 million households, making them the largest unsubsidized source of affordable housing in the country (Durst and Sullivan 2019; CFED 2009). Compared to owned and rented housing, MHPs are unique in several ways. Most importantly, MHPs are predominantly divided-tenure communities where residents own their housing unit but rent the land underneath, an arrangement that limits the rights and capacities of park residents. MHPs are privately owned, profit-seeking businesses whose owners have many of the responsibilities that would normally fall to a local government, like on-site infrastructure and service delivery. Finally, MHPs and their residents are stigmatized within popular culture and parks have become unwanted land uses in many communities.

How do the unique characteristics of MHPs structure residents' risk to disaster? The limited scholarship on MHPs and disasters,

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which largely focuses on the physical vulnerability of mobile homes and the sociodemographic characteristics of resident populations, provides only partial answers to this question. Researchers have documented the lesser protection afforded by mobile home units to certain types of hazards (e.g., Bolin and Stanford 1991; Flanagan et al. 2011), the disproportionate siting of MHPs on hazardous land like floodplains (e.g., Baker et al. 2014; Pierce et al. 2018), and the concentration of socially vulnerable households in MHPs who are relatively less prepared for disasters (e.g., Fothergill and Peek 2004; Chaney and Weaver 2010; Kusenbach et al. 2010). No study has holistically examined the interaction among the full range of factors—including divided-tenure, private ownership, and the regulatory treatment of parks—that together shape disaster risk for park residents.

This paper begins to address this gap through an exploratory case study of the 2013 Colorado flood, a federally declared disaster that destroyed hundreds of mobile homes across multiple parks and communities in the north-central region of the state. The central research question examined here is this: What characteristics structured disaster risk for MHP residents before and after the 2013 flood? This question requires looking beyond the physical characteristics of mobile homes and taking into account both the internal characteristics of parks (e.g., location and population) and external factors like their legal and regulatory treatment.

The paper proceeds in five parts. It begins by describing the prevalence of MHPs in the United States as an affordable and attainable housing type. Next, the literature on affordable housing and disasters and the limited research on MHPs are reviewed. Third, the Colorado flood is introduced, and the authors' research design and data collection methods are described. Fourth, the impacts on MHPs and park residents in three Colorado communities— Lyons, Evans, and Milliken—are described. Then, drawing on their case study research, the paper discusses five ways in which MHP residents were at risk to the flood. The paper concludes by describing the importance of MHPs in the broader landscape of community risk and resilience, and several avenues for future research are proposed.

Mobile Home Parks: Affordable and Attainable Housing

Mobile homes are a significant, but understudied, source of housing in the United States (Beamish et al. 2001; Aman and Yarnal 2010; Dawkins and Koebel 2009; Pierce et al. 2018). Mobile homes, sometimes called manufactured homes or trailers, are housing units built in a factory on a permanent steel chassis and then affixed to a foundation. Originating as travel trailers or "auto campers" in the 1920s, mobile homes emerged as a major source of permanent, single-family housing during the post-World War II housing boom (Wallis 1991). The 1970s marked a rapid spread of both mobile homes and MHPs. In the context of federal cuts to affordable housing production (Sullivan 2018b), the number of manufactured units grew from just 315,000 in 1950 to 3.3 million in 1973 (Wallis 1991). Despite their name, modern-day mobile homes are very immobile structures; once installed, they are difficult and costly to move. In fact, less than 20% of modern mobile homes are ever moved from their original foundation (CFED 2011). Mobile homes have changed significantly over the past several decades, from the small campers and travel trailers of the early 20th century to the spacious double- and triple-wide manufactured homes popular today. The share of the US population living in a mobile home has more than doubled since the 1970s, to 6.3% today (US Census Bureau 2017). Throughout the 1980s, mobile homes were the fastest growing housing type in the US and in the 1990s were responsible for 66% of the new affordable housing in the country (Apgar et al. 2002). There are now over 8.5 million mobile homes in the United States (US Census Bureau 2017). An estimated 2.7 million mobile homes are located within MHPs, unique land-lease communities that are found in all types of US communities, from large metropolitan areas (Sullivan 2017) to small towns (Baker et al. 2011) and rural places (HAC 2011; Salamon and MacTavish 2017). Considered together, MHPs represent a substantial portion of the country's affordable housing supply, providing more than twice as many units as conventional public housing developments (HUD 2016).

MHPs can offer deep levels of affordability compared to renterand owner-occupied housing. Indeed, mobile homes are often used by residents as an ownership or price-stabilization strategy to avoid escalating prices in rental markets (Schmitz 2004; Apgar et al. 2002; Zhou 2013). On a square-meter basis, excluding the cost of land, the average price of a new mobile home was less than half that of a site-built, single-family home in 2015 (\$511.84 average cost per square meter for mobile homes compared to \$1,083.42 for site-built housing) (US Census Bureau 2015; US Department of Commerce 2010). Nationally, 73% of households living in mobile homes earn less than \$50,000 a year, and MHPs house an even lower-income population than mobile homes generally because they do not require residents to purchase land (Durst and Sullivan 2019). Although not all low-income households have available resources or credit for a mobile home purchase, MHPs can still offer an affordable alternative to rental housing. Sullivan's (2018b) study of MHPs in Texas and Florida, for example, demonstrated that very-low-income households often use cash savings to purchase previously owned or low-cost mobile homes inside MHPs for prices ranging from \$6,000 to \$10,000. After the purchase of the home, residents' monthly housing costs for lot rent were as low as \$200-well below workforce rental housing in their areas. Beyond their affordability, mobile homes also share some amenities with single-family homes, like private yard space, which makes them preferable to multifamily housing for some people (Sullivan 2018a).

Attainability has also contributed to the growth of MHPs as a housing choice for households with low incomes. MHPs tend to have fewer barriers to entry than publicly subsidized affordable housing, which is associated with significant wait lists, bureaucratic requirements, and more extensive background checks. In smaller towns and rural communities that do not have the resources or capacity to maintain public housing programs, MHPs are a common source of affordable housing (MacTavish and Salamon 2009). Additionally, because mobile homes are financed as personal property (chattel) rather than real estate, they are attainable through a different set of loan products that may be more accessible than conventional mortgage products (CFPB 2014).

Affordable Housing, Mobile Home Parks, and Disaster Risk

Disaster risk, an estimation of the possible adverse effects of a natural hazard on "assets" like people, infrastructure, or the environment, is strongly influenced by the built environment, including housing (Wisner et al. 2004, p. 11; Bosher 2008; Haigh and Amaratunga 2010; Comerio 2014; Peacock et al. 2018). Disaster risk is determined by three interrelated components: a natural hazard, an inventory of the assets exposed to that hazard, and the vulnerability of those assets (Cardona et al. 2012). Vulnerability, when referring to people, is the "characteristics of a person or group and

their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard" (Wisner et al. 2004, p. 11).

Research has shown that affordable housing is at greater risk to natural hazards than the overall housing stock. Affordable housing tends to have higher exposure to natural hazards (e.g., Bolin 1985; Zhang and Peacock 2009; Highfield et al. 2014), and in highly segregated housing markets, affordable neighborhoods often suffer from disinvestment and neglect and have less infrastructure and fewer services to mitigate risk (Hendricks et al. 2018). Rebuilding affordable housing after disasters is also a major challenge (Bolin 1985; Berke et al. 1993; Smith and Wenger 2007; Comerio 2014). Postdisaster housing recovery tends to proceed more quickly in higher-income areas and for single-family homeowners rather than renters (Bolin and Stanford 1998; Comerio 1998; Peacock et al. 2014), and the cost of rebuilt housing tends to increase, making it less affordable (e.g., McKenzie and Levendis 2010). Additionally, Greene et al. (2017) find that high housing costs have historically intersected with discriminatory market practices and exclusionary land-use policies, to the detriment of communities of color (Turner and Rawlings 2009; Turner et al. 2014), which are often disproportionately vulnerable to disaster (Elliot and Pais 2006; Bolin and Kurtz 2018).

This literature on affordable housing and disasters largely excludes MHPs (Lee and Van Zandt 2018). The limited studies on MHPs and disasters narrowly focus on three issues: the disproportionate exposure of MHPs to natural hazards, the physical vulnerability of mobile home structures to those hazards, and the sociodemographic makeup of park residents.

First, there is considerable evidence that MHPs tend to be disproportionately located in areas exposed to natural hazards. Over the past several decades, mobile homes have become especially more prevalent in regions prone to disasters. For instance, mobile homes compose upwards of 15% of the housing stock along the southern Atlantic and Gulf coasts, which are highly exposed to hurricanes and floods (US Census Bureau 2017). Hurricane Harvey, one of the costliest disasters in US history, severely impacted the Houston metropolitan area, where almost 2% of all mobile homes in the US are located (Najmabadi 2017; US Census Bureau 2017). At a more local scale, there is also some evidence that MHPs tend to be located on land exposed to natural hazards. Historically, MHPs have often been sited on undesirable, surplus, or marginal land like floodplains (Williams 1998; MacTavish 2007). Simmons and Sutter (2007) and Prasad and Stoler (2016) independently calculated that one-third of all mobile homes in South Florida are located in the 100-year floodplain and onequarter in the storm surge zone. Similarly, Baker et al. (2014) find that 32% of MHPs in Vermont are located at least partially in a floodplain. A study by Kellner and Niyogi (2014) found that MHPs in Indiana are often located in "transition zones" between urban areas and forested land cover, which increases their exposure to tornadoes (Kellner and Niyogi 2014).

Second, studies have focused on the physical vulnerabilities of mobile homes, and especially older homes. As a housing type, mobile homes (both those located in MHPs and on privately owned land) have been shown to be vulnerable to certain hazards, especially high-wind events (Prasad and Stoler 2016). During Hurricane Andrew in 1992, for instance, mobile homes were 21 times more likely to be destroyed than single-family homes owing to their construction and installation standards (Morrow 1999). Ashley (2007) found that 45.4% of all tornado fatalities in the United States in the period 1986–2005 occurred inside a mobile home, although newer mobile home units perform significantly better than older ones (Simmons and Sutter 2008). Studies also document the higher

physical vulnerability of mobile homes to tropical storms, especially older homes and those that are improperly secured to their foundation (Bolin and Stanford 1991; Pearson et al. 1996; Golden and Adams 2000; Flanagan et al. 2011; Kusenbach et al. 2010).

Finally, disaster researchers have noted that populations living in mobile homes tend to have higher social vulnerability than the overall population (Cutter et al. 2003; Fothergill and Peek 2004; Chakraborty et al. 2005). Social vulnerability refers to the susceptibility of groups to potential losses from natural hazards (Blaikie et al. 1994), and increased vulnerability is associated with being in poverty (Fothergill and Peek 2004), female (Enarson and Marrow 1998), under 18 or over 65 years in age (Ngo 2001; Fothergill and Peek 2015), a racial or ethnic minority (Peacock and Girard 1997; Elliot and Pais 2006), and an immigrant (Bolin and Kurtz 2018), among others. MHP residents, as a group, share many of these characteristics. Nationwide, 67% of MHP residents age 25 or older have a high school education or less, compared to 37% of residents in site-built homes (CFPB 2014). Households in MHPs also have lower median assets (about \$45,000 compared with \$213,000 for families in site-built homes) and lower median net worth. Residents in MHPs are often elderly, and their households are more likely to have a member with a disability (Florida Senate 2006). Latinos, American Indians, and Native Alaskans make up a significant share of MHP residents (CFPB 2014), and MHPs are known to house a large population of recent immigrants (Hart et al. 2002; Schmitz 2004).

Existing studies use the share of mobile homes in the housing stock as a proxy indicator of social vulnerability (Cutter et al. 2003; Wood et al. 2010; Flanagan et al. 2011), but only a handful have connected the high concentration of socially vulnerable households in MHPs to specific disaster outcomes. Kusenbach et al. (2010) examined the hurricane readiness of MHP residents in Florida and found that social vulnerability was a root cause of residents' lack of preparedness. Chaney and Weaver (2010) found that mobile home residents in Tennessee were less prepared and less responsive to a 2008 tornado event than the overall population.

In summary, the limited studies on MHPs and disasters have illuminated some key aspects of risk, but many important questions remain. How do the unique characteristics of MHPs, including their private ownership, divided tenure, or treatment under local laws and regulations, intersect with their spatial and sociodemographic characteristics? How does living in a MHP shape a household's recovery after a disaster? And where do MHPs fit, or not fit, in the disaster recovery policy landscape? To answer these questions, a comprehensive analysis of MHPs and disaster is needed that examines the interactions among the myriad physical, social, and institutional factors that structure risk.

Research Design and Data Collection Methods

This paper draws on an in-depth case study of the 2013 Colorado flood. In the period September 9–15, 2013, a heavy precipitation event in north-central Colorado triggered one of the worst disasters in the state's history. The flood killed 13 people, displaced 18,000 more, and caused nearly \$4 billion in damage (Gochis et al. 2015; Aguilar 2015; CRRO 2017). The flood was especially damaging to the region's housing stock: altogether it destroyed 1,800 homes and damaged 19,000 more. At least 12 MHPs containing 1,300 mobile homes were affected, a significant blow to the affordable housing supply in a region already facing historic housing challenges (Newcomer and Resnick 2018; Rumbach et al. 2014).

Contemporaneous accounts of disasters are useful because they document the "revealed" vulnerabilities of people and systems

in ways that can be instructive for reducing future disaster risk (Birkmann 2006; Masys 2016). This study used an exploratory case study research design that is appropriate when there is a lack of detailed preliminary research on a phenomenon (Mills et al. 2010) and when researchers aim to generate insights for further study (Yin 2014). The impacts of the 2013 flood on MHPs are examined in three hard-hit Colorado communities: Evans, Lyons, and Milliken. These study sites were selected so as to represent the broad range of communities with MHPs affected by the floods, from towns (Lyons and Milliken) to small cities (Evans), as well as the range of overall damage that MHPs suffered. The goal of the case study is to generate hypotheses about the risks to MHPs generally, which can later be tested across a larger sample of parks and natural hazard contexts. Complementary qualitative and quantitative data were collected for each community over a 30-month period (2014–2017) on the key components of risk to the flood-exposure and vulnerability. At the household level, 101 households whose homes were significantly damaged or destroyed, including 44 households who lived in MHPs, were purposefully sampled and surveyed. Purposeful sampling involves identifying individuals who are especially knowledgeable about the phenomenon under study and are available and willing to participate and share their experiences (Palinkas et al. 2015). The survey instrument used included closed- and openended questions on social, economic, and housing characteristics of the respondents, their postflood conditions, and their experience with the recovery process. Potential respondent households were identified through visits to damaged MHPs and parks where flooddisplaced households had relocated, advertising at local businesses like laundromats and grocery stores, snowball sampling from survey participants, and outreach through recovery groups. Once identified and contacted by the authors' research team, approximately 85% of households chose to participate in the study. The surveys were then administered in person in English or Spanish, except for three instances where participating households were only available by phone. In addition, follow-up interviews were conducted with 10 Spanish-speaking households from 3 MHPs to better understand the unique recovery challenges they faced. At the local and state level, semistructured interviews were conducted with 28 key

informants who were active in the recovery, including local government staff and elected officials, nonprofit staff, and citizen activists. The questions ranged from enquiries about recovery policy to specific questions about the vulnerability of MHP residents. The interviews were recorded and transcribed for analysis. In addition, dozens of housing recovery-related meetings, workshops, and events were directly observed, and agendas and minutes from additional meetings were reviewed. Finally, government documents related to the recovery, such as local and county recovery plans and action plans for federal recovery grant programs, were collected and analyzed. The interview transcripts and government documents were coded in several cycles, initially to organize the data according to the existing literature on MHP housing or disasters and housing, and to identify emergent themes and patterns, and later to focus the analysis and generate concepts (Saldaña 2015).

2013 Colorado Flood and Its Impact on Mobile Home Parks

The 2013 Colorado flood began in the mountains, when 40 cm (15 in.). of precipitation fell along the Front Range (a metropolitan region east of the Colorado Rockies) in a single week. As the water rushed toward the plains below, it caused widespread damage across an 18-county region. This section describes the impacts of the flood on six MHPs located in three communities: Evans, Lyons, and Milliken (Fig. 1). Table 1 summarizes these findings.

Evans is a fast-growing agricultural community in Weld County that had a population of 19,700 at the time of the flood (US Census 2014). The South Platte River, which flows through Evans, broke its banks and protective levees in several areas near and within the city. The impact on housing was severe; the floods seriously damaged or destroyed 259 homes, including 203 mobile homes in 2 MHPs—Bella Vista and Eastwood Village (City of Evans 2014). The Evans parks were home to mostly low-income Latino families, many of whom worked in the local agricultural, oil and gas, and meat-packing industries. Neither of the MHPs was in the



Fig. 1. Location of Evans, Lyons, and Milliken along Front Range.

Table 1. Study MHP characteristics and recovery status

Mobile home park	Community	Year constructed	No. of units	Units destroyed	Recovery status (January 2019)
Bella Vista	Evans	1970s	50	50	Permanently closed—vacant, awaiting redevelopment
Eastwood Village	Evans	1972	155	153	Permanently closed—vacant, pending lawsuit
Riverbend	Lyons	1950	30	28	Permanently closed—land now used as wedding venue
Foothills	Lyons	1970s	16	15	Permanently closed—acquired for open space
Greenwood Village	Milliken	1980s	35	21	Partially reopened
Martin Family Trailer Park	Milliken	1970s	10	6	Partially reopened

mapped floodplain at the time of the flood, but the city considered those maps to be outdated and inaccurate. On September 17, 2013, the City of Evans passed three emergency ordinances with significant consequences for the MHPs and their residents: the first placed a moratorium on permits for building or development within a new "special flood hazard area" described by the city; the second required approval from the City of Evans for any cleanup activities within this new "special flood hazard area"; and the third authorized the chief of police or "any duly authorized official" to prohibit access to areas deemed to be unsafe (City of Evans 2013; Ordinances 571-13, 572-13, and 573-13). The phrase "special flood hazard area" appears in quotes because, at the time of the emergency declaration, it was a locally determined area and not the official special flood hazard area (SFHA) demarcated by the city's flood insurance rate maps. Both MHPs were included in this "special flood hazard area" and deemed unsafe, and individual mobile homes within the parks were marked with red tags to indicate they should not be reoccupied. The parks were fenced off and residents were given limited access to their homes to collect belongings. Nearly every mobile home in both parks was damaged beyond repair, and legal questions about the ability of the park owners to dispose of the homes led to an 8-month delay in cleanup (Romano 2014). As of January 2019, both MHPs remain closed, and the owner of Eastwood Village is engaged in a lawsuit against the city claiming malfeasance and discriminatory treatment (see findings in what follows).

Lyons, a small town of 2,000 people in Boulder County, sits at the confluence of the North and South St. Vrain Creeks in the foothills of the Rocky Mountains. The floodwaters turned the normally quiet creeks into raging rivers, destroying much of the town's infrastructure, park space, utilities, and other public facilities (Town of Lyons 2014). A total of 211 housing units (more than 20% of the housing stock, and 90% of its affordable housing stock) were damaged or destroyed, including 43 mobile homes located in 2 parks-Riverbend and The Foothills. The population living in the parks was mostly low income and non-Hispanic white and included many elderly couples and families with small children (Rumbach and Gossard 2015). The Riverbend MHP, established in 1950, had 30 homes at the time of the flood, all but 2 of which were significantly damaged or destroyed. Riverbend was located almost entirely in the regulatory floodway, which severely limited its recovery potential, especially as a site for permanent housing. In 2014, its owners were granted a special use permit to reopen the property as a commercial venue for weddings and other special events, including the setup of 22 tiny homes on wheels as overnight temporary accommodations for guests (Town of Lyons 2016, p. 1). While FEMA declared some of the trailers in the Riverbend MHP repairable, owners were largely unable to afford to relocate them or find parks willing to take them because of their age (Bryen 2014a, b). The Foothills MHP had 16 mobile homes at the time of the flood, all of which were destroyed (Reinholds 2017). The park was later purchased by the town through a federal property buyout program, which requires that the land be left undeveloped in perpetuity.

Milliken, a small agricultural town in Weld County with a population of 5,900, also suffered extensive damage during the flood. Milliken is located between several small creeks, agricultural ditches, and the Big Thompson and South Platte Rivers, all of which flooded. Besides damaging important road, bridge, and industrial infrastructure, the flood destroyed 35 mobile homes and damaged 8 more in 2 MHPs—Evergreen and the Martin Family Trailer Park. Initially, nearly all damaged mobile homes in the parks were "red-tagged" by the city, indicating that they were unsafe to occupy. After further examination, some units were deemed repairable, and residents were allowed to begin living on site to prevent them from becoming homeless, given the acute shortage of affordable housing in the town and county (Draper 2013). Residents were only allowed to move back after signing an affidavit ordered by the town, however, stating that their park might be included in the floodplain of an updated flood map, and "...[i]n such instance, I may be required to relocate my mobile home in the future at my own cost... I understand that this relocation might be outside Milliken" (Brown and Crummy 2013). By early 2019, approximately 35 of the 43 mobile homes across both parks had been repaired or replaced, a process that has been slow and expensive for the park owner and residents owing to new floodplain rules and development regulations. For 3 years after the flood the town government considered pursuing federal "buyout" money to acquire the parks for flood mitigation purposes, but those plans were eventually shelved.

Findings

This section describes five key findings about MHPs and risk to the 2013 Colorado floods. The findings, which relate to hazard exposure and the vulnerability of households to the disaster, are all informed by the unique characteristics of MHPs as a housing type.

Mobile Home Parks Had Higher Exposure to the Flood Than Housing Generally

Hazard exposure is the "extent to which a unit of assessment falls within the geographical range of a hazard event" (Birkmann et al. 2013). The MHPs in this study were all exposed to flooding at a higher rate than other types of housing. In Evans, the MHPs contained 89% of all housing that was severely damaged or destroyed in the flood and 99% of the housing that was permanently lost. In Milliken, 98% of the homes damaged or destroyed were in MHPs. In Lyons, mobile homes accounted for less than 5% of the town's

housing stock before the flood but 25% of the housing that was significantly damaged by the flood. While all the parks were exposed to flooding, the level of exposure varied between places. In Evans and Lyons, nearly every mobile home was directly exposed to the flood, meaning they suffered direct damage. In Milliken, while some mobile homes were directly exposed, others suffered indirect exposure. That is, by virtue of being located in a MHP that suffered direct damage, even undamaged homes were indirectly affected when they were subject to costly new development requirements for the parks to reopen (see findings in concluding section). Further, the owners of mobile homes that were undamaged or repairable, but located in parks that closed, were financially responsible for moving their units-a costly, uncertain, or even impossible process. In Lyons, for instance, one mobile home escaped damage, but its owners were forced to move it out of the county because of restrictions on the age of mobile home units (i.e., mobile homes built prior to HUD-code standards are no longer allowed to be installed in parks as per county regulations). The owners also struggled to afford moving the home, a process that cost nearly \$5,000, or 20% of their annual income. Members of two other households who were interviewed could not afford to relocate their units from damaged parks and were forced to surrender or abandon them.

These findings are consistent with studies showing that MHPs are located on more hazardous land relative to site-built housing (see section "Affordable Housing, Mobile Home Parks, and Disaster Risk"). Why do MHPs tend to be exposed to hazards at a higher rate? The Colorado case points to a likely explanation. Many MHPs in the United States, including five in this study, were established prior to modern floodplain rules and were situated on low-value land that was flood prone. Owners of MHPs, who typically do not own the housing units themselves, have an incentive to locate parks on low-value land (to increase profits) or were required to do so by local laws and policies that excluded them (see subsequent discussion). Further, as modern floodplain rules and regulations have come into force, many MHPs have been designated as so-called legal nonconforming uses under local regulations, meaning they are allowed to stay in place even if their use is no longer allowed. Jurisdictions have long practiced this form of so-called constructive exclusion by only allowing MHPs on lands where they have already existed (Bernhardt 1980). This likely incentivizes park owners to stay in place and avoid substantial improvements to their property, even if they are located on flood-prone or hazardous land, because such changes would trigger new and costly regulations that might make parks financially unviable.

Mobile Home Park Residents Had High Social Vulnerability to Disaster

This study shows that MHPs in Colorado spatially concentrate households that are socially vulnerable to disasters by virtue of their incomes, age, race/ethnicity, and immigration status, among other characteristics. In terms of income, the households located in MHPs whose members participated in the survey conducted for this study were low income, with a median household income of \$25,000, compared to \$55,000 for the other survey participants. The survey sample compares to a state median income of \$60,629 (2011–2015, in 2015 dollars) and county median incomes of \$71,000 (Boulder County) and \$60,000 (Weld County). Households living in MHPs were larger, on average, than those living in single-family or multifamily housing and were more likely to have a member who was over 65 or under the age of 5. Respondents living in MHPs were also more likely to report being a racial or ethnic minority. While the MHPs in Lyons were mostly non-Hispanic White, nearly all

(97%) of the residents of parks in Evans and Milliken were of Hispanic or Latino origin, compared to 29.3% of the population overall in Weld County (US Census Bureau 2017). Respondents were also more likely to speak a language other than English at home. A large majority (67%) of households living in MHPs at the time of the flood reported speaking Spanish at home, compared to just 2% of non-MHP households. This compares to a county-wide rate of households whose members speak Spanish at home of 16.2% (Boulder) and 19.5% (Weld), according to the US Census Bureau (2018). Of those survey respondents living in MHPs, 63% were born outside the United States, compared to just 4% of respondents living in single-family or multifamily housing. Further, 59% of households living in MHPs had at least one member who was not a permanent resident of the United States, compared to 2% of other survey respondents.

The interactions between group-level characteristics of social vulnerability and individual-level experiences with disasters are complex, varied, and intersectional (Wisner 2016; Jacobs 2019). Most immediately, this study shows that the low incomes of MHP residents affected their ability to prepare for and recover from the disaster. Just 7% of MHP respondents in this survey had flood insurance, compared to 23% of respondents living in single-family or multifamily housing. It is important to note that mobile home owners are eligible for federally backed flood insurance policies, like any other homeowner living in a participating community (including all of the areas in this study). And yet, the share of households that purchase insurance is heavily dependent on whether they are located in a high-risk area like a regulatory floodplain or have a home loan (Petrolia et al. 2013; Kriesel and Landry 2004). The low coverage of households in this study is likely due to factors that intersect with income, like the ownership of older, lower-cost homes purchased without a loan product that requires insurance. In addition, many of the mobile homes in this study were located outside of regulatory floodplains at the time of the flood, and thus insurance is an optional expense that households would be less likely to spend their income on.

Further, because of their displacement and the time burdens associated with accessing recovery resources, 50% of respondents in MHPs reported a disruption in their employment due to the disaster, whether from reduced hours, reduced pay, loss of employment, or being forced to change employers. Lastly, the loss of a mobile home as a household asset was financially difficult for many households, especially those with very low incomes. As one interviewee described:

These folks just lost everything. If you live in a mobile home, whether it's a year old or 20 years old, when it goes down the river you've lost everything, you know ... I mean everything went down the river, literally.

This was reflected in the survey conducted for this study, where 18% of respondents from MHPs reported experiencing a period of extreme financial hardship as a result of the flood.

Mobile home residents' displacement from their communities was also difficult due to their economic circumstances. A case manager in Colorado who worked closely with displaced households described his frustration from interacting with federal officials, who were reluctant to provide on-site transitional housing:

I tried explaining to them that some of these people didn't even have vehicles or transportation, and that for someone to relocate to [nearby communities] would be a big deal. It would be very difficult for them. If they wanted to work in, or if they were working in [their community], it would be very difficult for them. Soon after the flood, FEMA determined that Boulder and Weld counties had adequate supplies of rental housing to accommodate flood displaced households and that they wouldn't establish on-site temporary housing to accommodate flood-displaced households. MHP residents were thus forced into temporary and inadequate housing arrangements, like living in a hotel room or with friends or relatives, or pushed into a competitive and expensive housing market. A nonprofit representative summarized the challenge:

So those folks... were displaced into a housing market that's tough. And it's not just tough in Weld County, it's tough in the entire region.

Before the flood, the MHPs had offered an unusually affordable housing option, due to their age and divided tenure model. Across all six parks, the average rent on a mobile home "lot" was just \$425, compared to average prices for two-bedroom apartments in Boulder and Weld County of \$1,900 and \$1,200, respectively. In this survey of flood-affected households, 62.2% of respondents from MHPs reported having increased living expenses due to the flood, compared to just 21% of households living in single-family or multifamily housing. Similarly, a postflood needs assessment commissioned by the Town of Lyons found that households displaced from rental housing, which included former residents of MHPs, were more likely to be cost burdened (spending more than 30% of their income on housing and utilities) or severely cost burdened (more than 50%) postflood compared to owners (Town of Lyons 2014, pp. 13–14). The sudden loss of housing in a local or regional market can also lead to an overall increase in prices, financially burdening vulnerable households or displacing them through increasing rents, a phenomenon described as disaster gentrification (Rumbach and Makarewicz 2016; van Holm and Wyczalkowski 2018). A case manager in Weld County described the problem in Colorado, where state law prohibits rent caps or rent control measures:

If I'm a property owner and I've been charging \$500 a month rent and the flood hits and housing is now a premium, if I want to turn around and charge you \$1,500 a month rent, there's nothing you can do about it. You either take it or leave it. People were being asked to move out of housing they had lived in for a long time because it could be rented for more.

In all three communities, the long-term closure of the MHPs likely meant permanently displacing residents because there was no supply of affordable housing to absorb them locally. Households' low incomes intersected with other dimensions of vulnerability as well, like age. One elderly resident described her postdisaster financial and health struggles:

The cost of everything has gone up...rent, transportation, utilities, everything. I've stayed in five different places since the flood. I am [elderly]. I fell twice cleaning out my trailer and broke my ankle and wrist, and so I can't work very much now. I want to return [to my community] but at this point I can't see it happening.

"Socio-Spatial Stigma" of Mobile Home Parks Influenced Recovery Decisions

Despite their popularity, MHPs are routinely stigmatized within American popular culture (Aman and Yarnal 2010). Studies have shown that residents of MHPs have low social prestige and suffer from prejudicial class and race-based assumptions about their transience, poverty, and crime (Kusenbach 2009, 400). Sullivan (2018a) found that over the last century, social perceptions of MHP residents as migratory, unattached, and a drain on local resources intersected with planning and zoning practices that relegated MHPs to inferior and marginalized parcels within local communities, a place-based nexus she refers to as "socio-spatial stigma" (53).

In Colorado, the MHPs were indeed found to be stigmatized, which compounded the social vulnerability of park residents in different ways. First was the perception among numerous state and local government officials that households living in MHPs, especially in Milliken and Evans, were transient, temporary, or not especially attached to their community—beliefs that were partly informed by an inaccurate, but widely held, assumption that mobile homes are easily moved or that their residents are not particularly bound to a place (Kusenbach 2009). For example, one interviewee in Evans described his impression of flood-affected households:

... it was more of a transient population. There was a number of undocumented immigrants within that population. I talked to one person who was like, "Well I have lost my job or work, I'm not career-based, I'm not tied to a job here"... I think what we saw was a lot of transient population or people that could easily move to another place just move out.

The assumption that MHP residents were transient ran counter to the reality recorded in these communities. When surveyed, households living in MHPs in Evans, Lyons, and Milliken at the time of the flood had lived in their community, on average, for 10.2 years (median = 9 years). They also reported having good relationships and strong social ties with their neighbors. For example, when asked about the statement "Prior to the flood, I lived in a close-knit neighborhood," 89% of respondents agreed or strongly agreed, compared to 48% of respondents living in single-family or multifamily housing. When asked if they were aware of neighborhood or town get-togethers in the previous year, an indicator of community embeddedness, a substantial majority of households living in MHPs (68%) replied in the affirmative. Reflecting on her household's experiences, one Evans respondent explained:

It's not all about the material losses...in seconds we lost what we had built for years. We were very happy there [in the Eastwood Village MHP]. Our new trailer park is prettier but we would rather have our old community.

Another stigma of MHPs was that they were home to criminals, a common stereotype of low-cost or subsidized affordable housing (Tighe 2010). In Weld County, for instance, one key public official referred to unfounded rumors about criminal activity to frame the loss of MHPs as an overall benefit to the community: "... we heard there were quite a few families living in each of those trailers... we even heard a few [methamphetamine] labs were put out of business [by the flood]." In Lyons, where voters turned down a federally funded affordable housing development that would have prioritized flood-displaced households (Burness 2015), the main opposition group frequently referred to the potential increases in crime that might occur if affordable housing were to be rebuilt.

The stigmas associated with MHPs very likely shaped perceptions about the needs of displaced MHP households, the desirability of their return, and, thus, recovery decisions. In Evans, where local officials had assumed that MHP households were temporary or transient, one interviewee described how the lack of contact from the MHP population validated their belief that they did not have a strong desire to return: "We didn't see a lot of community groups or bands of residents after the flood saying, 'Hey, what are you going to do to bring us back to Evans?" When asked if there were efforts to locate and contact displaced households, however, numerous interviewees in Evans and Milliken could not describe any engagement beyond public recovery meetings. The lack of knowledge about MHP residents is perhaps not surprising, given their low level of interaction prior to the flood. In this survey, just 11.1% of MHP households reported having regularly communicated with local government officials before the disaster, compared to 54% of households living in single-family and multifamily housing. When asked about their knowledge about the MHPs prior to the flood, public officials in all three towns referred to the park owners, rather than residents, as their source of information and point of contact.

For the broader public, many of whom were not directly impacted by the floods, numerous interviewees referenced the infrequent contact between households living in MHPs and their non-MHP neighbors as an important contributor to the lack of empathy during recovery. After the vote that rejected a recovery affordable housing project in Lyons, an interviewee central to the public outreach effort described socio-spatial stigma as an important factor that influenced voters:

If you just look at the way the town is laid out, there's lots of people who do not know the folks whose homes and trailers were washed away. In my conversations with people who were organized in opposition to [the affordable housing recovery project], they were incredibly skeptical that there was value in very specifically recovering the economic range of rooftops that we lost. That was not important to do. They weren't willing to see the value in those individuals.

Postdisaster Regulatory Exposure Was a Barrier to Recovery

In the United States, local governments guide housing development through land-use regulations like building codes, zoning codes, and subdivision ordinances. New construction, or properties that are being majorly renovated or redeveloped, must comply with these regulations. When housing is substantially damaged during a disaster, in situ recovery typically means that property owners must build back to contemporary codes and standards, a process termed here *postdisaster regulatory exposure*. Postdisaster regulatory exposure was a key factor that influenced the recovery of the MHPs in this case study, because all six parks were built prior to modern floodplain rules and before their local governments instituted stricter land-use rules.

Two types of postdisaster regulation were particularly important for MHPs after the Colorado floods. First were contemporary floodplain regulations. In the United States, communities that participate in the National Flood Insurance Program must regulate development in mapped floodplains (FEMA 2009). Communities in Colorado typically prohibit new development or substantial improvement to existing development in floodways (channels that tend to convey the most water) and require that development in the 100-year floodplain meet modern standards like elevating structures to above the height of modeled flood events. The six MHPs in this study were differentially located relative to the regulated floodplain. In Evans, neither park was located in the regulatory floodplain at the time of the flood, according to floodplain maps that had last been updated in 1979. In Lyons, Riverbend was mostly in the floodway, while Foothills was in the 100-year floodplain. In Milliken, neither park was in the 100-year floodplain, though the maps also dated back to 1979.

After the flood, all three communities applied contemporary floodplain development regulations to the MHPs. In Lyons, the Riverbend MHP could not be rebuilt because of the property's location in the floodway. The Foothills park, which was located almost entirely in the 100-year floodplain, was allowed to rebuild, but only if the trailers were elevated above the base flood elevation (BFE), which the owner considered before he decided it would be too costly. In Evans, both MHPs were located outside the regulatory floodplain, but the city argued that the floodplain maps were outdated and needed to be revised in order to reflect true flood risk. Immediately after the flood, the city included both Bella Vista and Eastwood Village in a "special flood hazard area," a temporary determination that restricted the MHP residents' ability to return to their parks and repair their damaged homes while the city revised its regulatory floodplain maps. This new floodplain map (effective on January 20, 2016-more than 2 years after the flood) included all of Eastwood Village MHP and only small parts of Bella Vista MHP in the 100-year floodplain, and amended their city code to require that all manufactured homes in the floodplain be elevated at least 18 in. above BFE. The code stipulated that the "redevelopment" of a property would trigger these requirements, including redevelopment due to a natural disaster. These postdisaster regulatory provisions forced both MHPs to close permanently. A lawsuit filed by the owner of Eastwood Village alleges that the emergency regulations were selectively applied to MHPs, noting that households living in nearby single-family developments in the floodplain were allowed to return to their homes and rebuild (EWV, LLC v. City of Evans, Colorado 2017). In Milliken, the town adopted temporary floodplain maps postdisaster, which expanded the flood hazard area beyond what was officially regulated by FEMA to include the MHPs. As such, MHP residents were required to clear a series of costly regulatory hurdles in order to rebuild, like acquiring flood development permits and elevating their homes. While both MHPs remained open, today they provide 25% less housing than before the flood.

The second type of postdisaster regulations that MHPs were exposed to after the Colorado floods was contemporary development codes, which tend to be more restrictive than when parks were originally established. Contemporary development codes regulate MHPs in numerous ways, like restricting the age of mobile home units allowed in a park, requiring larger lot sizes or setbacks than older parks, or imposing landscaping, skirting, and other aesthetic conditions, among other requirements. While the impact of contemporary development codes on flood-damaged parks varied by context, in this study's cases they disallowed the reopening of parks without a rezoning process or imposed substantial new requirements. In Evans, for instance, the city required that the Bella Vista Park meet a host of new requirements before it could reopen:

We've got new standards for density that were probably written ten years ago: landscape bufferage, that kind of thing, access and design. And so, to the [mobile home park] owner, we said, "you are under these new standards, even if it's a disaster and act of God it's still considered an abandonment of use."

Postdisaster regulatory exposure is likely an important issue for MHPs nationally, because many parks were built during a twodecade period from 1950–1970 before the rise of contemporary floodplain rules (Wallis 1991). They have also become unwanted land uses in many communities. In a national study of metropolitan plans and regulations, Dawkins and Koebel (2009) found that many jurisdictions had adopted restrictive or exclusionary regulations to discourage or prohibit the use of mobile homes (p. 74). A disaster can work to accelerate the loss of MHPs by triggering these contemporary regulations.

Postdisaster Recovery Policies and Programs Disadvantaged Some Mobile Home Parks and Park Residents

Postdisaster housing recovery in the United States is a process mediated by a patchwork of federal and state programs and policies intended to provide immediate and long-term assistance to households and to mitigate losses from future disasters (Peacock et al. 2007; Gotham 2014). Federal housing recovery funds, which are typically received and then administered by the state, are generally designed around the needs of single-family homeowners and renters. In Colorado, federal recovery resources tend to disadvantage MHPs and MHP residents relative to other housing types. For example, following the 2013 flood, the state used two federally funded property "buyout" programs-one funded by FEMA the other by HUD-to offer flood-affected homeowners preflood market value for their homes, a financial benefit to help them relocate to higher ground. For MHP owners, however, the state's buyout program only offered postflood value for their property, a significantly lower amount. In the case of the Foothills MHP in Lyons, this meant that the owner was unable to afford suitable land outside the floodplain to rebuild his park, despite an interest in doing so. A town official described the state's decision:

Early on, the state had told us pre-flood value [for mobile home park buyouts], so we had these very expensive appraisals done. And then the state came out with this policy... that they were going to go with post-flood values instead, on mobile home parks. That is a huge difference in values. Foothills was \$680,000 pre-flood. It's \$180,000 post-flood. It's a huge difference ...

Why were MHP owners only offered postflood value for their properties? Ultimately the state decided that commercial property owners should not be compensated the same as single-family homeowners, even if they were providing housing. In Evans, a local official said that the state was choosing to treat MHPs like any other business... "they might of well have been a hardware store." The state's thought process, according to an interviewee familiar with the deliberations, was "this money shouldn't go to benefit private property owners who are in business. It's not there to make business owners make more money." It is important to note that the MHP residents, who were renting their lots, had no voice in this deliberation—only the park owners.

Another example of the uncertain place of MHPs in disaster recovery was the exclusion of MHPs as a potential housing type for postdisaster recovery. None of the case study communities attempted to use recovery resources to relocate or rebuild flooddamaged park properties, partly due to the confused messages local officials received from their state and federal partners. For more than a year after the flood, towns like Lyons were told that manufactured housing would be ineligible for federal recovery dollars. Later, the state clarified that federal recovery dollars could be used to build a new MHP, but it informally advised that such projects would likely be less competitive for funding than site-built housing. When asked why a MHP might not be a suitable recovery housing model, numerous state and federal interviewees referred to the private ownership of parks, quality of the housing, and the unfamiliarity with MHPs by state and federal housing agencies administering the grant monies as key barriers to overcome. One state housing official casually remarked that the community would be the "first community in Colorado outside of Greeley that wanted to build a new mobile home park" in many years. One other Boulder County official put it plainly: "It's an uphill battle for that kind of housing." In Evans, the owner of Bella Vista was told by state and federal recovery officials that his property would be more competitive for recovery assistance if he were to redevelop it as a site-built affordable housing project, which informed his decision to close his MHP business (Romano 2014).

In the aftermath of the flood, numerous local officials identified the uncertain and sometimes contradictory handling of MHPs as an important issue to address before future disasters. At a workshop on "lessons learned" during the 2013 flood, attended by 45 state and local officials from flood-impacted communities, participants agreed that they needed to "stop pretending that mobile home parks are a new entity" and recommended that state and local governments "put MHP policies in place" before more disasters occurred. One participant described MHPs as "not like other types of housing," arguing that a significant number of low-income households "fell through the cracks" of the state's housing recovery programs. An interviewee expressed a similar sentiment when discussing the issue of whether to value MHPs with their pre- or postflood value for buyout purposes: "It's not your typical commercial operation. It involves people's homes!"

Conclusion and Directions for Further Study

The foregoing case study of the 2013 Colorado flood demonstrates how MHPs are an important component in the US affordable housing stock that is uniquely at risk to natural hazards and disasters but poorly understood in the disaster recovery research and policy literature. Understanding the risks to MHPs and their residents is important for community resilience to disasters, in Colorado and elsewhere in the United States. The households living in MHPs are often among the most vulnerable groups in communities, and MHPs are a vital source of affordable housing in communities ranging in size from large cities to towns and rural areas. In Colorado, MHPs filled a critical gap in the housing market that was not being met by market or state-subsidized housing. After the disaster, the loss of MHPs was a significant blow to housing affordability and resulted in the permanent displacement of hundreds of low-income and socially vulnerable households from their communities.

This paper contributes to the literature and research on housing and disasters generally by looking beyond the physical vulnerability of mobile homes to holistically consider how their other characteristics structure disaster risk. It was found that disaster risk for households living in MHPs was structured before, during, and after the flood in five different ways: (1) by having higher flood exposure than housing generally, (2) from high social vulnerabilities among MHP households, (3) from the "socio-spatial stigma" that characterizes MHP properties, (4) from postdisaster regulatory exposure, and (5) by postdisaster recovery policies that restricted recovery options. These findings advance the literature on disaster risk by showing how the tenure arrangements embedded in housing types interact with, and are treated differently by, government policies and regulations in ways that can increase hazard exposure and complicate long-term recovery after disasters.

Although this case study examines a range of MHPs, its findings are limited by its focus on a small number of parks in a single geographic region and disaster event. These findings should be considered as a set of hypotheses about MHPs and disaster risk and recovery generally. Future research should identify and test measurable variables for the exposure and vulnerability of MHPs and park residents to future flood events. Further, a study of disaster recovery that includes a larger and more representative group of MHPs, studied longitudinally, could test these hypotheses in parks with different ownership structures, sociodemographic characteristics of residents, regulatory environments, and exposure to different natural hazard types. Given the finding that flood-impacted MHP housing represented a sizable share of the affordable housing stock in Evans, Lyons, and Milliken, other lines of research might test the impact of disasters in MHPs on the availability and accessibility of communities' affordable housing supplies. This research will be especially important as the number of MHPs in hazard-prone regions rises and global climate change makes extreme events more frequent and severe. These findings could also be used to proactively protect MHPs as a source of affordable housing. Specific mechanisms identified here, such as postdisaster regulatory exposure and gaps in postdisaster recovery policies, could yield policy prescriptions for addressing disparities in the disaster risk of America's third housing type. These findings are also useful for understanding the link between housing tenure and disaster vulnerability in other communities with divided-asset ownership like colonias, informal subdivisions, and informal settlements (Sullivan and Olmedo 2015; Rumbach and Shirgaokar 2017), which are common sources of affordable housing in the United States and other countries.

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