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Earth, Wind, and Fire: Wildfire Risk Perceptions in a Hurricane-Prone Environment

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Wildfire is one of several potential disturbances that could have extraordinary impacts on individuals and communities in fire-prone areas. In this article we describe disturbance risk perceptions from interviews with residents in three Florida communities that face significant wildfire and hurricane risk. Although they live in areas characterized by emergency managers as having high wildfire risk and many participants have direct experience with wildfire, residents tended to share high hurricane and low wildfire risk perceptions. The different perceptions of risk seem linked to several factors: direct hurricane experience, different scales of impact, the local "hurricane culture," effectiveness of local ordinances and development patterns, perceived predictability of the event, and perceived ability to control the event. This study shows that residents may perceive and act to reduce risk for one disturbance in relation to their perceptions, concern, and actions for another.

Keywords adaptive capacity, environmental disturbance, environmental hazard, social construction of risk

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In the United States, costs related to wildfires, including number of acres burned, resources threatened, and associated suppression costs, have been steadily increasing. In 2012 alone, 67,774 wildfires burned more than 9 million acres on private, state, and federal lands, with suppression costs totaling more than $1.9 billion (National Interagency Fire Center 2013). The majority of wildfires in the United States burn in the 14 contiguous Western states plus Georgia and Florida (Hammer et al. 2008). Policymakers have responded in part by attempting to engage property owners and communities in wildfire mitigation and preparedness. Property owners are encouraged to maintain defensible space, and the 2009 Quadrennial Fire Review promotes development of fire-adapted human communities as a core strategy in addressing the complex challenges of wildland fire management. Fire-adapted communities take various actions to manage their wildfire risk, including maintaining defensible space, enacting regulations, adopting "leave-early-or-stay-and-defend" policies, and developing collaborative fire prevention and response approaches with federal agencies (Harbour et al. 2009).

Understanding public perceptions of wildfire risk is an important aspect of promoting a range of fire-adapted actions at multiple scales. Researchers have explored relationships between wildfire risk perceptions and adaptive behavior at individual (Martin et al. 2009; McCaffrey 2004; McGee et al. 2009) and community levels (Gordon et al. 2010; 2012). Yet people do not face wildfire risk in a vacuum. Wildfire is just one of several potential disturbances that could have extraordinary impacts on individuals and communities in fire-prone areas. While policies and programs are typically disturbance specific, risk perceptions and adaptive behaviors often develop relative to other issues in people's lives (Eriksen and Gill 2010), including potentially competing environmental disturbance threats.

Studies that explore the relationship between natural hazard risk perception and adaptive behaviors also tend to focus on a single hazard (McGee et al. 2009; Paton et al. 2008; Peacock et al. 2005). An exception is Perry and Lindell (2008), who quantitatively examine risk perceptions and mitigation behavior for wildfires, earthquakes, and volcanic activity. Yet while they simultaneously analyze multiple threats, Perry and Lindell evaluate each threat separately. Contextualizing hazards risk perceptions by considering the multihazard environment remains a gap in the literature. An important next step to understanding collective wildfire risk perceptions and adaptive behavior is to consider how these are embedded in a broader biophysical risk context that includes risk from multiple environmental disturbances.

In this article we describe disturbance risk perceptions of residents in three Florida communities that face significant wildfire and hurricane risk. Our original objective was to explore the applicability of elements of wildfire adaptive capacity (defined in the following) found in other U.S. regions to Florida communities (Paveglio et al. 2009; 2012). However, when interviewing residents, we found that their perceptions of disturbance risk were based almost exclusively on hurricane risk. Although emergency managers identified wildfire as a significant threat to the area, there was little awareness among residents. This preliminary finding led us to expand our research. In the following analysis we explain factors contributing to social construction of disparate wildfire and hurricane risk perceptions among residents and discuss implications for adaptive capacity.

Literature Review

Understanding risk perception provides insight into why people act—individually and collectively—to reduce their risk (i.e., potential adversity). It is also important to advancing understanding of adaptive capacity, which we posit is the ability to take action that reduces risk within evolving structural circumstances (Newman et al. 2013). Recently there have been calls for studies that go beyond characterizing adaptive capacity to unpacking the "motivational context" that mobilizes capacity into action (Bohensky et al. 2010; Haddad 2005; Kelly and Adger 2000). These calls have been prompted by the observation that capacity to adapt does not necessarily lead to implementation of adaptive decisions (Adger et al. 2005; Rudberg et al. 2012). While wildfire risk perception and awareness do not necessarily translate into action (Daniel 2008; Steelman 2008; McCaffrey 2004), risk perception is fundamental to the motivational context underlying wildfire adaptation (McCaffrey et al. 2011). Wildfire risk perceptions have been found to be influenced by factors such as values (Bright and Burtz 2006), awareness of related environmental risk factors like climate change (Schulte and Miller 2010), media coverage (Jacobson et al. 2001), and previous wildfire experience (McGee et al. 2009).

Adaptive capacity is often built at the community level through interactions among residents who have developed collective perceptions and values through the course of shared experience (Jakes and Langer 2012). Actions communities and residents themselves take before, during, and after an environmental disturbance depend largely on shared risk perceptions (Tilly 1973; Flint et al. 2009). While it is influenced by objective factors such as local socioeconomic and environmental conditions, the notion of risk is largely socially constructed. Focusing on social constructions of risk allows researchers to examine how social actors frame environmental disturbance events and "the processes that are involved in the social production of knowledge about risk" (Tierney 1999, 522). Flint (2007, 1598) defines community risk perceptions as "collective expressions of anxiety, fear, or concern due to a commonly understood threat of loss or harm to community residents, property, and/or values." Informal social interactions among residents in a community facilitate development of shared risk perceptions, facilitate information sharing, and affect homeowners' wildfire mitigation decisions (Brenkert-Smith 2010). Gordon et al. (2012) found that social and cultural characteristics can influence shared wildfire risk perceptions. In their risk-related framework, Flint and Luloff (2007:423) suggest that "action is influenced by: (1) a community's biophysical and socioeconomic risk context; (2) a shared community perception or social construction of risk; and (3) local interactional capacity to work together on community issues and problems."

Much of the literature attempts to explain the "action–awareness gap." For example, direct experience with wildfire does not necessarily increase risk perception or action (Martin et al. 2009). McCaffrey (2004, 511) summarizes qualitative characteristics of wildfire that may help explain low risk perceptions: "Years of successful fire suppression contribute to a feeling of control; the extent of most wildfires is reasonably limited; and there is generally enough warning to be able to evacuate, thereby avoiding fatalities." Winter and Fried (2000) alternatively found Michigan homeowners unlikely to engage in mitigation because they perceived wildfires as random and uncontrollable.

While little work has contextualized wildfire risk perception by considering it relative to other environmental disturbance threats people face, research does

substantiate the contention that wildfire risk is often simply not salient compared to other daily concerns (McCaffrey 2004). Eriksen and Gill (2010) examine the gap between wildfire risk awareness and action in the context of landowners' routine decisions and concerns. They find that even when landowners are aware of wildfire risk, they often prioritize other social, economic, or environmental issues. In this study, we contribute to the literature by examining residents' collective perceptions of wildfire risk relative to hurricane risk in three Florida communities.

Methods

Selection of Study Sites

Local land and emergency managers suggested two case-study sites in Lee County, Florida (Pine Island and Northwest Cape Coral), that faced significant exposure to wildfires and hurricanes. A third site was included because it frequently experiences wildfire (see Table 1), has a reputation throughout Lee County as a high-fire-risk community, and is located inland (as opposed to the coastal setting of the other two communities) (see Figure 1). Northwest Cape Coral (NCC) is a preplatted subdivision and an incorporated section of the city of Cape Coral. Pine Island (PI) is a rural and agricultural area with four unincorporated population centers: Matlacha, PI Center, Bokeelia, and St. James City. Lehigh Acres (LA) is an unincorporated preplatted subdivision.[1]

Data Collection and Analysis

An inductive grounded theory approach to social science research was used to gather and analyze data (Glaser and Strauss 1999). This approach was appropriate because little research has explored risk perceptions and adaptive capacity in a multihazard environment (Corbin and Strauss 2008). Data were collected until emergent themes and responses stabilized and no new information was forthcoming from additional interviews (Glaser and Strauss 1999). In total, 77 in-depth, semistructured interviews were conducted with 94 participants in March, May, and June of 2012: 36 interviews (42 participants) in PI, 30 interviews (39 participants) in NCC, and 11 interviews (13 participants) in LA. There are more participants than interviews because in some cases two or more members of the household were interviewed together. The first two to three participants in PI and NCC were identified through organizations' websites (civic groups, homeowner's associations, etc.). The first participants in LA were identified with assistance from emergency managers. Most subsequent participants

Table 1. Number of wildfires responded to by study site fire departments, 2008–2012

Year	Cape Coral	Pine Island	Lehigh Acres
2008	12	39	160
2009	10	36	195
2010	10	21	159
2011	6	48	189
2012	11	29	202

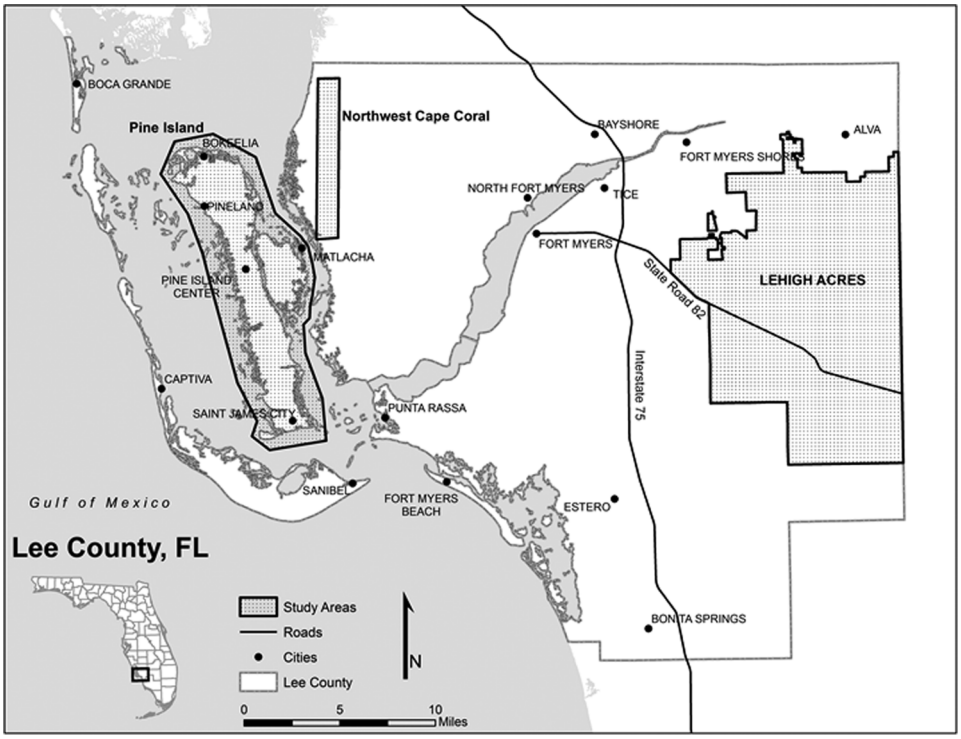

Figure 1. Map of Lee County, Florida, study sites.

were identified through snowball sampling and recruited to represent citizen types with whom we had not yet spoken. In the case of NCC, additional participants volunteered through an announcement published in the NCC Neighborhood Association newsletter. Participants were asked open-ended questions that covered three topic areas: (1) community characteristics, relationships, and concerns; (2) wildfire risk perceptions, experiences, and preparedness; and (3) hurricane risk perceptions, experiences, and preparedness. For example, participants were asked to describe the extent to which wildfire/hurricane is a risk to their household/community and what they do individually/collectively to reduce their risk. Ninety-two participants were interviewed in person and two interviews were conducted by phone. Interviews lasted between 60 and 90 minutes, were audio-recorded, and were transcribed.

ATLAS.ti qualitative data analysis software was used to code and analyze the data through a systematic process that included several phases: (1) Descriptive initial codes were assigned to segments of the data until all subsequent observations fit into established codes; (2) initial codes were organized into categories and subcategories, (3) remaining data were used to validate existing codes, and to refine analytical categories and subcategories; and (4) a conceptual analysis was conducted to answer specific research questions and to "identify patterns and relations in the data to see how various aspects of the findings [could] be integrated" (Charmaz 2006; Friese 2012, 235). Data were validated as key findings and patterns were discussed in depth with interview participants and among members of the research team, and local emergency managers helped ground truth the investigators' interpretation of results. Finally, quotations were selected that represent the results.

Results

Emergency Managers' Perceptions of Risk

According to Lee County Emergency Management, wildfires and hurricanes are significant events in Lee County with the potential to adversely impact the population (Florida Division of Public Safety 2007). Lee County is the 7th fastest growing county in Florida, experiencing a 40% growth rate since the 2000 census (Lee County Public Safety 2011). The area is projected to grow another 25% by 2060, with much of the development expected in the wildland–urban interface (WUI) (1000 Friends of Florida 2006). According to the Lee County Wildfire Protection Plan (CWPP) (Lee County Public Safety and Florida Division of Forestry 2011, 2), "Lee County was selected as one of 10 counties to receive assistance in developing a CWPP because of its high wildfire vulnerability relative to other counties in Florida . . . [and] the Florida Division of Forestry ranked Lee County as the most vulnerable county to wildfire in the State of Florida."

Table 1 provides a count of wildfires to which each community's fire department responded from 2008 to 2012. In that period, NCC, PI, and LA had an average of 10, 35, and 181 wildfires a year, respectively.[2]

Lee County has experienced 10 to 14 hurricane strikes since 1900 (National Oceanic and Atmospheric Adminstration [NOAA] 2013). Since 1960, five major hurricanes—defined by the National Hurricane Center as a hurricane that is classified as a category 3 or higher (NOAA/National Weather Service 2013)—have threatened the area. One environmental manager who helped select study sites conveyed a common view among professionals:

> There are [hurricane] workshops, a lot of outreach, education, media attention. It's a good comparison because there's the same amount of damage potential, but less preparedness and attention given to wildfire. Even though fires are a lot more frequent than hurricanes—the last big hurricane could be decades in the past. People don't realize how vulnerable they are to wildfire.

Other land management professionals saw wildfire frequency as helping to build adaptive capacity: "Complacency about wildfire is not as much of an issue among residents as it can be with hurricanes because wildfires occur frequently throughout the year" (wildfire mitigation specialist).

Residents' Risk Perceptions

Some residents said they perceive high wildfire risk; however, the majority of participants in all three study sites tended to perceive greater hurricane risk than wildfire risk, report they are more knowledgeable about how to mitigate/prepare for a hurricane event, and indicate they are more likely to deliberately take action to reduce hurricane risk. The perception of hurricane risk was generally based on experience from two hurricanes—Hurricane Donna in 1960 and Hurricane Charley in 2004. Even residents who perceived low hurricane risk communicated knowledge of how to mitigate risk and prepare for hurricanes and typically engaged some adaptive action ["I'll be honest, at our house we make sure we have water and canned goods but I didn't put any shutters up—we live so far inland" (LA resident)].

In contrast, participants who did not perceive wildfire risk typically said they are not as knowledgeable about how to mitigate and prepare for wildfire events nor did they take deliberate action to reduce wildfire risk. Furthermore, their degree of exposure to wildfires seems to make little difference in many participants' wildfire risk perceptions. Even residents who have been directly threatened by wildfires did not tend to express concern:

> I've never prepared for a fire; I wouldn't know [how]... I've lived here [my whole life] and we've never really worried [about] fires... We used to have to stand outside with a hose... until the fire department came. That happened a couple times where a fire... burned the woods all the way around the house. (LA resident)

Factors Influencing Risk Perception

Analysis suggests that different risk perceptions for each disturbance are primarily linked to six interconnected factors: different scales of impact, local "hurricane culture," direct experience, effectiveness of local ordinances and development patterns, perceived predictability of the event, and perceived ability to control the event. These factors emerged as important to the social construction of risk in all three communities. We explain each finding in more detail in the following.

Scales of Impact

Hurricanes and wildfires can present residents in the same locality with different levels of exposure and impact. Participants indicated that the spatial extent of hurricane impacts is unparalleled by wildfire. They believe hurricanes affect everyone in their community and broader region to some extent, whereas wildfires are comparatively small in scale, impacting only isolated and sparsely populated areas. The scale of a hurricane can influence how wildfire risk is perceived and prioritized:

> A hurricane is much more massive and extensive... Our forest fires here maybe [destroy] two or three homes... rather than a hundred homes... Therefore one has to look at what their priorities are. Which would be the biggest disaster? (NCC resident)

Many participants described how property damage caused by hurricanes diminishes residents' wildfire risk perception and suggested wildfire damage would be easier to recover from: "If [my house] burns down... I've got insurance. I'll have it fixed and more than likely [after a fire] you don't have 300 people needing to rebuild at one time [like you do] when a hurricane comes through" (PI resident).

Some participants also contrasted the time it takes to recover from a hurricane to a wildfire. Many pointed out that the large spatial extent and population affected by a hurricane often results in a significantly longer recovery period: "[Emergency managers come] in with their [hurricane] disaster group and say, 'You're gonna be doing this for anywhere from two to five years.'... Wildfires usually are more contained" (PI resident).

The different temporal, damage, and spatial scales of wildfire impact mean it has been experienced as a nonevent by most residents when contrasted to the scale of hurricanes.

Local "Hurricane Culture" and Ubiquity of Information

Most participants talked about hurricane risk as an expected part of life in Florida. Preparing for hurricane season was therefore described in terms of a "way of life" or cultural practice:

> It's never once occurred to me to prepare for a wildfire . . . [Hurricanes] just seem to be part of the life here that by the first of July you have all your supplies and you're ready to go . . . I never think about wildfires, *ever* unless one happens . . . and we live in the woods. (PI resident)

Participants tended to describe a ubiquity of hurricane information and messaging, from hurricane evacuation route signs to merchants' hurricane supply advertising to local media coverage: "I think people probably [have high hurricane adaptive capacity] because all the news media talks about hurricanes, hurricanes, hurricanes" (LA resident). As one PI resident summarized, residents perceive themselves as more prepared for hurricanes because "they get a lot more information about hurricanes—told about it a lot more." Another participant observed:

> Hurricanes . . . come every year and . . . they have seminars, there's flyers in the newspaper that have a list of what you need for preparation . . . So it's just beat into you . . . every time the hurricane season comes around that you need to be prepared. They talk about the shelters and you can see the evacuation signs . . . So [hurricane] is front and center all the time as to where fire is such a hit and miss thing. (NCC resident)

The Hurricane Charley experience resulted in a cultural memory related to the event, so that Charley's impacts on risk perceptions and residents' actions have not been limited to those directly affected. Several participants who moved to Lee County years after Charley described a process of social learning through which hurricane risk and mitigation measures continue to be informally communicated. Social interaction within the community has affected many residents' behavior:

> [Hurricanes are] very much [an issue] because Charley came through in 2004 . . . we weren't here . . . but we knew our neighbors because we'd visited . . . and they said it was really terrible. Even the builder of our home—he and his family were without water for a week—and that's one of the reasons we put a generator in. (NCC resident)

Participants commonly perceive and respond to hurricane risk more than wildfire risk partly due to a hurricane culture with pervasive hurricane information and messaging.

Direct Experience

Many participants noted that prior to Hurricane Charley residents had generally low hurricane risk perception and preparedness at the household and community levels. Most participants who experienced Charley in 2004 described it as a catalyzing event—with residents recognizing the importance of preparedness activities:

> Prior to Charley . . . we'd have . . . "block parties." We would literally put people's furniture up on blocks . . . and then we'd gather at the local bars

> and have a few adult beverages. That went on for . . . a 40 year span where there were no storms of any consequence. Then Charley hit us. People . . . no longer just go "we'll see you down at [the bar]." You are prepared. (PI resident)

Direct Charley experience prompted even long-time residents to "take hurricanes more seriously." Many participants described specific household-level adaptations they made after Charley, which commonly included updating or acquiring storm shutters and buying a generator: "After Charley we went ahead and had shutters put on the house and we bought a generator" (PI resident). Participants conveyed how experience with Charley has affected greater hurricane risk perceptions and prompted implementation of hurricane adaptation measures among residents.

Effectiveness of Local Ordinances and Development Patterns

Local ordinances and development around reservoirs and canals were often cited as reducing wildfire risk and affecting risk perceptions in NCC and PI. These structural factors have an important role in the perception and reality of wildfire risk. NCC, for instance, has enacted a citywide lot mowing ordinance intended to control vegetation, remove invasive plant species, and limit vermin populations. This ordinance has reduced wildfire risk for many residents. As one local firefighter and NCC resident explained:

> We used to have [wildfire] problems . . . before they put an ordinance in place that required mandatory lot mowing. Whether you built on your lot or not you're still responsible for maintaining its grass . . . and people pay a small fee to make sure those lawns are cut. Prior to that we'd have wildfires here; it could go from block to block.

Not surprisingly, the city ordinance has influenced not only NCC residents' perceptions of wildfire risk, but also their perception of the action required to reduce wildfire risk. As an unincorporated area, some residents of PI referred to county ordinances, which are seen as a mechanism to enforce vegetation management: "Lee County has ordinances on keeping your lots and your land clean and people are pretty good about letting somebody know if they think their neighbor's yard isn't kept up the way it should be" (PI resident).

In addition to local ordinances, many participants in NCC and PI pointed to certain development characteristics they perceive as reducing wildfire risk. In some areas of NCC and PI many people live along canals or reservoirs. Overall participants perceived the significance of these water features for reducing wildfire as twofold: as fire breaks—"There's a lot of wildfires in Florida lately, but . . . NCC . . . is like Venice, there's . . . 400 miles of canals and so I don't think of fires spreading very easily" (NCC resident)—and as water sources:

> Even though there may not be city water, the problem isn't that acute because you have canals and you have lakes, so all you got to do is dump a hose in there and [firefighters] can pump forever more. (NCC resident)

In this multidisturbance environment, living on water presents greater hurricane risk whereas the same structural elements are seen as attenuating wildfire risk. As one PI resident explained, "I'm much more concerned about hurricanes living right here on the water than I am about fire."

Perceived Predictability of Event

Another factor affecting perceptions of wildfire and hurricane risk, according to participants, is the ability to observe a hurricane forming and to receive advisory statements well before the storm makes landfall. Hurricanes also have a predictable, discrete season. Wildfire is perceived as a random event that can occur throughout the year for which residents get no warning:

> I don't even put them in the same category . . . maybe it's because wildfires are so damn random and they can be started by a strike of lightning or somebody welding or throwing a cigarette out that I don't think about (A) that being a natural disaster and (B) being anything you could've prepared for. (PI resident)

The hurricane warning affects the amount of time, when, and frequency with which residents have to take adaptive action. It is partly this warning that sets hurricanes apart from wildfires:

> You can . . . pick up stuff, board the windows . . . prepare in the time the hurricane is coming. So consequently you don't have to be prepared on a . . . regular basis . . . when [wildfire] happens, it's happening right now and there's no preparation. (NCC resident)

There are many actions Lee County residents can take over the course of several days, once they know the likelihood of being exposed to a specific storm (e.g., by putting up storm shutters, buying extra supplies, and deciding whether and where to evacuate). Many hurricane actions residents take can be initiated once they know a hurricane is coming. A longer, yet discrete, window of opportunity means residents are more likely to engage in some level of hurricane risk-reducing action. In contrast, wildfire adaptation is perceived as requiring continuous activity and awareness: "People have to be more in tune for wildfire because there's no advanced warning. Nowadays with a hurricane you get a week" (LA resident).

Many participants argued that because wildfire events are less predictable, residents are less likely to exert the energy necessary to be in a constant state of readiness: "Hurricane has a season. You know when your risk is so people are more apt to get prepared. Fires happen all the time so you have to be prepared all the time" (PI resident). As residents typically do not receive the same amount of warning for wildfires, some participants communicated a fatalistic attitude about wildfire adaptation. The unpredictability of wildfires supports a widespread notion that communities can only react once a wildfire occurs, as opposed to being proactive.

> Ongoing [hurricane] predictions . . . put you in a state of readiness. With fire you don't have that. You think, "well, it is going to be lightning and how do you prepare for that? We will cope with it if it happens."

> With the hurricane it is, "we will cope with it even before it happens." (PI resident)

Participants tend to experience wildfires as smaller, random events, contrasted with hurricanes that occur within a predictable season and with plenty of forewarning. The predictability of each disturbance affects the nature of action (e.g., continuous or discrete) required for communities and households to be adaptive.

Perceived Ability to Control the Event

Another common theme is the notion that wildfires, once ignited, can be controlled by humans, primarily emergency managers, while hurricanes cannot. Many participants in all three localities expressed tremendous respect for their local firefighters and emergency managers and believed in these professionals' ability to contain and control wildfires. Some participants felt the ability of professionals to control wildfire let communities "off the hook"—precluding a need for communities or households to also take action. According to participants, the inability of professionals to "contain and control" a hurricane focuses more responsibility for preparedness on communities and residents themselves.

> Obviously you're not going to stop Mother Nature, so a hurricane's going to do what it's going to do . . . Where with a fire . . . [firefighters] can control it . . . A hurricane's out of everybody's control . . . But . . . these these guys are really, really good here in the state of Florida at containing fires. (NCC resident)

Most participants have seen firefighters effectively respond to and, in most cases, control wildfires before private assets are negatively impacted. In contrast, most residents perceive they cannot realistically depend on professionals to offer assistance and a similar level of protection during a hurricane. Different notions constructed around humans' ability to control each disturbance type affect the level of personal responsibility and action residents engage in to reduce risk. That is, participants widely perceive wildfire adaptation as the responsibility of professionals, whereas most participants said it is up to individuals to prepare for and mitigate hurricane risk themselves.

Discussion

Research has shown that wildfire risk perceptions and mitigation behaviors are often developed relative to other issues and priorities in residents' everyday lives (Eriksen and Gill 2010). Communities' biophysical risk context often includes multiple, potentially competing (in terms of salience and priority) environmental disturbance types, and this study shows that residents may perceive and act to reduce risk for one disturbance in relation to their perceptions and concern for another. Florida residents involved in this study share high hurricane and low wildfire risk perceptions. In spite of the Florida Forest Service's ranking of Lee County as the county most vulnerable to wildfire in Florida (Lee County Public Safety 2011), low wildfire risk perceptions were conveyed even by residents who have had recent and/or multiple wildfire threats to their properties.

Community context can affect collective wildfire risk perceptions (Gordon et al. 2012). In spite of different incidence of wildfire events across study sites (e.g., in 2012 LA had more than seven times as many wildfires as PI and approximately 18 times more than NCC—see Table 1) and varied proximity of the three localities from the coast (i.e., PI is off the coast, NCC boarders the coast, and LA is approximately 30 miles inland), participants in all three localities shared surprisingly similar perceptions of wildfire and hurricane risk. This suggests a shared construction of risk prevails throughout Lee County, unifying perceptions across communities that actually have different biophysical and socioeconomic contexts as well as different degrees of exposure to each disturbance.

The cultural salience of hurricanes in this context may help explain why it is so much more a focus of local attention than is the case for wildfire. The narrative around hurricanes so dominates local formal, informal, and commercial messages about environmental risk in Florida that even residents who personally have had more experience coping with wildfire perceive greater hurricane risk. The cultural dominance of hurricane risk was amplified by a major hurricane event, namely, Hurricane Charley, the impacts of which were experienced in some way by all residents in the region. This study raises, but cannot fully answer, the question of whether a dominant risk crowds out risk perceptions and adaptive action for other hazards. More research is needed to understand risk perception in environments prone to multiple hazards.

This research also offers evidence of how effective preparedness marketing can be when combined with media coverage and personal experience. Officials and community leaders interested in increasing wildfire adaptive capacity might be able to learn from the "hurricane culture" phenomenon. One question begged by this research is, could images and testimonials related to human and community impacts of wildfire be a stand-in for personal experience? Perhaps the "hurricane awareness" system can incorporate messaging about wildfire preparedness. Would people be more likely to engage in the wildfire issue if it were linked to more salient information about hurricane preparedness?

Community biophysical characteristics and regulatory frameworks can have different implications for hurricane and wildfire risk perceptions and realities (Newman et al. 2013). In NCC and PI, canals, reservoirs, and vegetation management ordinances were perceived as attenuating wildfire risk while living along canals was perceived as amplifying hurricane risk. Residents also considered the scales of each event when evaluating their risk and prioritizing implementation of adaptive measures. Wildfires may occur more frequently, but when a hurricane impacts the area, potential numbers of people affected, damage, and recovery time have been much greater in residents' experience. In cases where temporal aspects of competing disturbance events vary (e.g., wildfire risk can be continuous throughout the year in Florida, whereas hurricanes have an advisory period and occur within a discrete season), residents faced with multiple disturbances may focus on the event that, like a hurricane, is easier to predict due to seasonality and/or technology and has the greatest potential to precipitate a large-scale disaster.

Many participants prioritized hurricane risk mitigation because it is perceived as a greater threat and, due to its discrete season and predictability, it is easier for communities and residents to engage in some degree of action once a hurricane is detected. Mitigation in advance of wildfire requires more energy or constant preparedness because fires can ignite throughout the year. Since hurricanes hit within

days or hours of residents taking action, they immediately perceive the benefits of the actions they have taken to reduce hurricane risk. With wildfire, property owners are asked to take potentially expensive and time-consuming mitigation actions that they are less likely to perceive as beneficial (Collins 2005; Daniel 2007; Martin et al. 2007). Furthermore, wildfires are perceived as randomly occurring, less threatening, and more controllable by professionals, in contrast to hurricanes. Our finding that residents perceive wildfire as both random and controllable builds on research suggesting that residents' behavior is influenced by the perception of wildfire either as a controllable event (McCaffrey 2004) or as essentially random and uncontrollable (Winter and Fried 2000).

Disparate perceptions of wildfire and hurricane risk in this study have important implications for adaptive capacity because "the ways risks are perceived within communities influence the range of actions undertaken to reduce them" (Flint and Luloff 2005, 408). The evidence here may suggest a negative relationship between hurricane and wildfire risk perception because participants are so focused on hurricanes. At the same time, we cannot assume that collective hurricane risk awareness and an emphasis on hurricane adaptation indicates that participants necessarily lack adaptive capacity for wildfire. A next step beyond this article would be to directly analyze the extent to which adaptive capacity built for a specific disturbance might generalize to adapting to other stressors. Where communities demonstrate strong adaptive capacity for one type of disturbance and less for others, natural resource and emergency managers can help communities identify and leverage the adaptive capacity they have already built to cope with other relevant hazards. Managers' risk mitigation strategies could be strengthened by assessing residents' perceptions of the risk they face from multiple relevant disturbances along with technical risk assessments. The ways residents construct and perceive wildfire risk do not always align with managers' assessments (Slovic 1987; Martin et al. 2008). Here participants' low wildfire risk perceptions diverged from those of many county- and state-level land and emergency managers.

Conclusions

Communities often face risk from multiple environmental disturbances. Therefore, understanding risk perception and adaptation has to be considered in the context of the multiple hazards communities face. Residents involved in this study live in an environment prone to wildfire and hurricane, yet they experience, perceive, and construct these events quite differently. Residents also perceive the risks and construct wildfire differently than emergency management professionals whose professional assessments indicate significant wildfire risk. Participants' collective perception of wildfire risk and deliberate behaviors to reduce it are low in light of the greater cultural and biophysical salience of hurricanes in Florida. While potential impacts presented by a single hurricane event may be greater and farther reaching than risks our participants have faced from a single wildfire, Lee County has been identified as one of the counties most vulnerable to wildfire in Florida, and multiple wildfire events threaten property, livelihoods, and potentially human lives every year. As population continues to grow in the WUI, the imperative for residents and communities to become more fire- and hurricane-adapted will be amplified (Lee County Public Safety 2011).

Understanding residents' collective perceptions of wildfire risk relative to hurricane helps contextualize wildfire risk perceptions and is part of the motivational

context underlying adaptive behavior. First, perception of risk is a necessary if insufficient factor motivating individuals and communities to build adaptive capacity and implement adaptive decisions. Therefore, attenuated wildfire risk collectively perceived, along with participants' behavioral accounts, suggests that residents have developed less adaptive capacity for wildfire at household and community scales. On the other hand, these results suggest that shared hurricane risk perceptions help promote high community adaptive capacity for hurricanes. The extent to which community adaptive capacity built to address hurricane risk is also applicable to wildfire risk should be further explored in future research. Natural resource managers and communities may be able to mobilize significant aspects of the adaptive capacity intentionally built for one hazard to develop an approach applicable to concurrently adapting to multiple sources of risk. Professional and community leader efforts might benefit from linking messages and activities to reduce wildfire risk to the disturbance with greater cultural salience. In this case, perhaps residents' wildfire risk perception and actions would be enhanced if more explicitly linked to the culturally salient issue of hurricane adaptation.

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Notes

1. Preplatted subdivisions are divided into lots and blocks. They developed from the 1920s to mid 1970s and differ from modern subdivisions. For example, where modern subdivisions are required to provide the majority of infrastructure to meet the development's needs and are relatively compact and proximate commercial centers, preplatted subdivisions provided minimal infrastructure in a small, core area and possibly no infrastructure in the rest of the development, and often were very large (up to 100,000 acres) with poor access to commercial areas (Collier County 2012).
2. Wildfire frequency data for each community were received in 2013 from each community's fire department via personal communications from the following sources: Pine Island (Jeff Roach unpublished data), Lehigh Acres (Ken Bennett unpublished data), and Northwest Cape Coral (Cheryl Mackowski unpublished data).

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