WILDFIRE MANAGEMENT IN THE WILDLAND URBAN INTERFACE:

ALTERNATIVES TO EVACUATION, SOCIAL DIVERSITY

AND MEDIA INFLUENCES

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Abstract

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Wildfire poses a growing risk to human settlements in the United States, and especially in the West. Adding to the difficulty of reducing such risk is the push to re-integrate wildfire as a natural ecosystem process; its long exclusion from U.S. ecosystems is one factor contributing to increased fire severity. This dissertation addresses a number of components related to the human dimensions of wildfire management in the U.S. West, including: (1) The development of alternatives to evacuation among fire-prone populations; (2) The impact of social diversity on community ability to adapt to wildfire risk and/or implement policies related to its management; and (3) The influence of the news media on public understanding and acceptance of wildfire or associated risks. Each of these foci reflect the growing recognition that private citizens need to take personal responsibility for their fire risk and collaborate with wildfire professionals from local and federal agencies. I define and outline the need for alternatives to evacuation as a means to protect human safety and property during wildfire. Analysis of newspaper coverage is used to illustrate how the media reflect and contribute to continued notions of fire exclusion and government protection from wildfire risk. Recommendations to advance the use of alternatives to evacuation are developed by drawing from fire and other hazard literatures. Case studies of

communities implementing alternatives to evacuation are used to develop theory concerning how and under what conditions they might be applicable. I use Structuration theory to discuss strategies for overcoming barriers to adoption of alternatives, including existing U.S. notions of fire management and the organizational structure of wildfire agencies. Central to this understanding is the recognition that social diversity among geographically disperse communities at risk for fire needs better understanding at a conceptual level. I draw from social and community theory to provide a model for understanding this diversity and its affect on adaptability to wildfire management in an effort to prompt a more systematic method for allocating resources (education, planning, money) to reduce wildfire risk and manage it effectively.

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CHAPTER 1: A BRIEF INTRODUCTION TO THE WILDFIRE PROBLEM AND THE EVOLUTION OF FIRE MANAGEMENT

The problem of understanding and mitigating human susceptibility to hazard events is hardly a new one in social science or public policy circles. However in the era of climate change, globalization and mega disaster events such as Hurricane Katrina, the Asian tsunami and the Haitian earthquake, the goal of understanding, predicting and mitigating the impact of such events on human communities has proven to be stubbornly elusive. This is particularly true in the area of local human community impacts of large wildfires in the U.S. The increasingly destructive nature of such events is driven by a number of factors, including climate change, the long-term effects of (some) past wildland management practices such as fire suppression and recent human settlement patterns in fire-prone ecosystems (USDA and USDI 2009).

Research on the "human dimensions" of wildfire emerged later than those of other hazards, and only recently have the results been compared to broader literatures on the subject. These comparisons have yielded multiple parallels between hazard events, including aspects of risk perception, mitigation, and social dynamics following a disturbance (Martin et al. 2008; Kumagai et al. 2006). Yet unlike other hazards, the role of residents' in reducing their wildfire risk has made much more dramatic changes in the last 30 years. For the better part of the 20th Century, federal, state and local government agencies took primary responsibility for protecting resident populations at risk for wildfire, most often through quick suppression and evacuation of populations that might be harmed by large fire events (Pyne 2001). The result has been generations of Americans who view fire as an alien and destructive event that we had sufficiently tamed and which had no place in our forests. This mindset began to change in the 1970s and has

grown to a focus on "fire adapted communities" comprised of individuals who must collaborate with fire professionals in the reduction of their risk (Daniel et al 2007).

Residents' expanded role in wildfire protection includes personal effort to reduced fuel loads near their homes, development and adherence to building standards that make homes more ignition-resistant, the (often) collaborative planning of local infrastructure (ingress, egress) and emergency protection procedures (i.e. evacuation routes, predictive models for fire spread), and acceptance of forest thinning or prescribed burning efforts on nearby lands (Cohen 2008; Cova 2005; Jakes et al. 2007). One outgrowth of these efforts has been increased interest in practices that would allow residents to remain at home during wildfire events. Such *alternatives to evacuation* have long been practiced by some (mostly rural residents) during wildfire events in the U.S. and other regions of the world (Handmer and Tibbits 2005; Cova et al. 2009). The progression of these ideas and their place in the evolving role of fire management is one major focus area of this dissertation.

Change has not been easy for the public or wildfire professionals. The former had to overcome decades of messages about the eradication of fire while coming to terms with the recognition that an old and potent risk had returned (Paveglio et al 2009a; Cohn et al 2008). Meanwhile, wildfire professionals (including federal agencies such as the U.S. Forest Service and local county or city fire departments) had created the largest professional firefighting system in the world. The development of these organizations and their ever-evolving mission came complete with rigid standards for success and training procedures that socialized members to believe they were heavily (and sometimes solely) responsible for the protection of Americans from wildfire (Desmond 2007).

Success in changing resident and professional perceptions of fire as a natural event they must collectively learn to live with and prepare for has been significant during the past 30 years (Shindler et al 2009; Shindler 2007), but we are far from a society that can regularly adapt to and recover from the impact of wildfire events. Large-scale evacuation from wildfire events are still a common spectacle on television screens and newspaper headlines. Fatalities and injuries from wildfires are slowly rising, as is the average amount of property and homes damaged by such events (NIFC 2010). Conflict still occurs between local residents who (often) demand that their private property be protected at all costs and external wildfire professionals who regularly neglect the important knowledge, concerns or efforts of local residents during their efforts to suppress wildfires (Carroll et al 2006; Carroll et al in press; Kumagai et al 2004). These occurrences demonstrate the need for critical review of existing approaches to the wildfire problem and the important contribution that social science can make in that endeavor.

Since the 2000 fire season, awareness of increasing wildland fire occurrence has been growing. We are beginning to understand the wildfire risk posed to an ever-expanding human population who may not be aware or willing to take on the responsibility of its management. At the center of this policy conundrum is the wildland urban interface (WUI), the area where residential development is juxtaposed proximate to wildland vegetation or public lands (USDA and USDI 1995). As more Americans settle this broad classification that ranges from the urban fringe to rural areas, natural resource and fire managers are attempting to balance the role of fire as a natural ecosystem event and the protection of private property. This is a problem for which no “clear” solution is evident (Carroll et al 2007).

The cost of battling fires in the WUI is one of the main reasons wildland fire suppression costs now total more than $1.5 billion a year (NIFC 2010). As detailed in an Office of Inspector General report:

> [Forest Service] managers and staff stated that WUI protection was the major driver of [Forest Service] suppression costs, with some staff estimating that between 50 to 95 percent of large wildfire suppression expenditures were directly related to protecting private property and homes in the WUI (USDA 2006, p. 7).A

Though a number of definitions exist concerning the size and occurrence of the WUI, current estimates indicate that it covers somewhere between 9% and 11% of the contiguous United States (Stewart et al 2007; Platt 2010). It is estimated that in some parts of the western U.S., the WUI could increase 40 % over current levels by 2030 (USDA 2006). Recognizing that wildfire protections in the WUI are becoming increasingly expensive and important, the federal government has created a number of initiatives to reduce the wildland fire threat in its borders, including the National Fire Plan, Healthy Forests Initiative, and Healthy Forest Restoration Act of 2003. These initiatives are supported by a sizeable body of research in the biological and physical sciences, including research on the ecology of fire dependent ecosystems, risk assessment, and reducing wildfire hazards in the home ignition zone (Cohen 2000; Arno and Allison-Bunnell 2002).

Just as important to the development and implementation of these policies, but less studied, is the ability of individuals, social groups and communities to take collective action to reduce the risk or impacts from fire events, and to adapt in the face of wildfire disturbances (Jakes and Nelson 2007; Steelman 2008; McCaffrey 2004). The dearth of research on the variability of

these characteristics among WUI communities ranging from the urban fringe of large cities to isolated and rural hamlets, each with their own local culture is another significant thread throughout the papers comprising this dissertation. Fire policies have generally treated the WUI as a uniform, homogeneous collection of people and human systems, with little recognition of the social complexity and variability that affects policy implementation (Paveglio et al 2009b). In particular, these policies do not take into account the varying abilities of different WUI communities to adapt in ways that increase resiliency and reduce vulnerability to wildland fire.

Dissertation Foci and the Evolution of Fire Management

The above introduction makes it clear that wildfires occupy a unique conceptual space in our understanding of hazards and their impact on human populations. Though they have clear parallels to other hazards such as hurricanes and earthquakes, wildfires have rarely been mentioned in the same category as these large-scale "disasters." Instead, wildfires have traditionally been described in the same sentence as extreme weather events (floods, windstorms), hazards that are highly variable among local populations and across landscapes (Daniel 2007; McCaffrey 2004). Increasingly, aspects of each characterization can be observed during wildfire situations.

Recent escalations in the severity of wildfire the growing population moving to areas at high risk for fire (the Wildland Urban Interface (WUI)) demonstrate that it is becoming a large-scale "disaster event." Severity and occurrence of wildfires is only expected to increase given the historical legacy of fire suppression, impacts of climate change and associated biological impacts such as bark beetle infestation. Future burns will impact a variety of populations in diverse

ecological, social and cultural contexts across North America (USDA and USDOI 2009).This is because unlike other hazards (i.e. hurricanes, floods) that are confined to ecological types, fire can occur in a number of ecosystems (i.e. chaparral or lodgepole pine), climatic conditions (Mountain West vs. Florida grasslands), social systems (urban fringe vs. rural) and cultural settings (strong local ties vs. low social capital) (Arno and Allison-Bunnell 2002; Paveglio et al. 2009).

The challenge in understanding and anticipating the impact of such events on human populations lies in balancing the variety of aspects (social, biophysical, cultural) that can cause a given fire event to be a large-scale "disaster" or a small-scale "disturbance." Adding to the complexity of this transition is the re-introduction of fire as a beneficial force in natural ecosystems. In order to reflect the complexity of wildfire risk and to advance its management as a natural ecosystem project, the subject matter of this dissertation has multiple foci. These include: (1) The evolution and applicability of alternatives to evacuation during wildfire events as a means to reduce wildfire risk and reduce suppression expenditures; (2) The role of social diversity in efforts create "fire adapted communities" in the WUI and increase resident collaboration with professionals; and (3) The role of the media on resident perceptions of wildfire risk, its mitigation, and its occurrence as a natural ecosystem event.

The individual chapters that comprise this dissertation can each be read as a separate entity. Every chapter following this one is developed as a publishable paper for academic journals. For this reason the citation style and other writing conventions may be specific to the given chapter. Yet taken together, these compiled chapters also share one or more of the common threads identified above. Their collective subject matter addresses what are some of the most important topics facing the wildfire problem. They also provide a blueprint for advancing

research on the human dimensions of wildfire and the practical solutions necessary to reduce wildfire risk in American communities. What follows is a brief introduction of the subject matter relating to each paper. The intent is to clarify the progression of these various arguments and provide a more cohesive argument for the dissertation as a whole.

Chapter 2

In this chapter I introduce the reasons behind increased U.S. interest in alternatives to evacuation and define the various types of practices that fall within that category. In it I review research specific to wildfires and other hazards to conclude that evacuation may not always be the safest or most preferred option for residents in *some* WUI communities. The chapter closes with a number of recommendations concerning the social, political and biophysical understandings in need of further understanding or research in order for the use of alternatives to evacuation to be possible.

Chapter 3

In this chapter I explore the role of the news media in public perceptions of wildfire occurrence and interactions between local residents and external firefighting professionals. I use discourse analysis (Fairclough 2003; Tischer et al 2002) and the concept of framing (Entman 1993; Chong and Druckman 2007) to demonstrate how newspaper coverage of wildfire both draws from broader social contexts and continues to perpetuate notions of fire exclusion. This is accomplished by focusing coverage on the threat to private property and in treating public lands as a "non-property." Similarly, resident support or criticism of firefighting efforts is presented as

contingent on the protection of private property. I conclude with recommendations for how journalists and professionals can better portray and advance the "era of fire inclusion." This presentation of this study occurs early in the dissertation to correspond because it helped inform later chapters.

Chapter 4

In this chapter I use Giddens' (1984) structuration theory to analyze adoption of an alternative to evacuation (shelter-in-place) created by officials in the Rancho Santa Fe Fire District, California. The research is based on approximately 70 interviews conducted with professionals and residents surrounding the Rancho Santa Fe Fire District. Results suggest that professional support and implementation of alternatives to evacuation are influenced by the breadth of their personal firefighting experience, constraints on innovation and perceived potential liability for damage from adoption of alternatives. Resident knowledge and understanding of shelter-in-place are also lacking. I make recommendations for integrating these findings into our understanding of wildfire management and community facilitation of its evolution. The chapter closes with broader suggestions concerning the continued development of alternatives to evacuation. Observations made during these field interviews serve as the basis for the theoretical and practical arguments concerning social diversity that anchor chapters 5 and 6 of the dissertation.

Chapter 5

In this chapter I present the knowledge and preliminary case study evidence needed to begin systematically documenting the differing levels and types of adaptive capacity WUI communities have for addressing collective problems such as wildland fire hazard. This focus draws on research concerning hazards, disaster and climate change in an effort to advance our conception of the variable social characteristics that promote sustainable human settlements that can adapt functioning in the face of risk. Central to these efforts are Wilkinson's (1991) Interactional approach to community and literature on place-based action (Kemmis 1990; 2001). I use secondary data from CWPP research in two California communities to illustrate how their social diversity impacted planning to reduce fire risk. This is the basis for my continued research efforts concerning wildland fire and the impact of disturbance on human communities. It plays a central role in the final paper of this dissertation.

Chapter 6

In this final chapter I analyze the social characteristics and antecedents that support the development of alternatives to evacuation in WUI communities beyond the urban fringe. Insights from chapter 5 are incorporated in order to question whether the diversity of WUI communities (social, ecological and political) influences the applicability of alternatives to evacuation (and their various forms). This research is based on approximately 50 interviews with local leaders and residents in Wilderness Ranch, Idaho, approximately 40 miles northeast of Boise. Select interviews with local and regional agency professionals also were conducted. I conclude that elements of local culture, knowledge and willingness to take work together among residents in

Wilderness Ranch have facilitated increased ability collectively deal with wildfire risk and supported development of alternatives to evacuation. I use these conclusions to discuss the variable necessity of alternatives to evacuation among diverse WUI communities and how local context is crucial to development of such practices. I close the chapter by situating alternatives to evacuation within the broader context of wildfire management and its evolution, including residents' changing role in fire protections and their increased interest in remaining at home during wildfire events.

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CHAPTER 2:

ALTERNATIVES TO EVACUATION:

PROTECTING PUBLIC SAFETY DURING WILDLAND FIRE

One of the most socially disruptive consequences of uncontrolled fire in the wildland-urban interface (WUI) is the evacuation of potentially large numbers of people, frequently with little or no warning, for undetermined periods of time (Taylor et. al 2005, Carroll et al. 2006). This disruption not only occurs in response to the actual movement of people from their homes to shelters or to the homes of friends and family, but also from being on evacuation standby for days or weeks at a time (Cohn et al. 2006).

No agency or group records the number of evacuations or number of people evacuated each year due to wildland fire, but there are reports from individual fires. For example, during the March 2003 Texas Panhandle fire, eight towns with a total population of more than 4,000 were evacuated (Zane et al. 2006). The Southern California Fire Complex of 2003 included the evacuation of more than 100,000 people (Blackwell and Tuttle 2003). Early stories coming from the October 2007 California fires estimated that one million people were evacuated (MSNBC 2007)

Threats to WUI resident safety from wildland fire are unlikely to decrease anytime soon; in fact, forecasts of an expanding WUI and recent fire statistics point towards an increased prevalence (Stewart et al. 2006, National Interagency Fire Center 2007). As wildland fires continue to pose a threat to WUI residents, evacuations will continue to be a possibility for thousands of communities. However, a debate has begun over alternatives to evacuation as a means of protecting the lives of homeowners, business owners, residents, visitors, and

firefighters in areas threatened by wildland fire. There is a small but growing body of literature indicating that evacuation may not always be the ideal strategy, because mass migration can create traffic problems or subject the affected population to more risk than if they stayed at home (Cova and Church 1997). Our intent in this paper is to highlight those arguments against evacuation and advance recommendations for alternatives to this process.

One possible alternative to evacuation that deserves additional review is the Australian model of "prepare, stay and defend, or leave early," which we will refer to as the Stay or Go Model. Stay or Go is the practice of staying in buildings or other designated "safe areas" during a disaster event and actively combating spot fires to ensure resident and structure safety (McCaffery 2007, Rhodes 2007, Handmer 2007). The related method of shelter-in-place (SIP) is a recognized alternative in the U.S. disasters such as chemical spills and the long-running standard during tornadoes (Mannan and Kilpatrick 2000, Hammer and Schmidlin 2001). The primary difference between these approaches is the level of resident involvement before and during the hazard event: shelter-in-place is a passive process of refuge while the Stay or Go Model is a multi-stage process in which proper home/neighborhood standards and resident efforts to combat fire are both needed to ensure resident safety and reduction of fire damage (Handmer 2007). This does not mean that the Stay or Go Model can work in every situation, nor would it always be the primary choice, but it has been proven effective in certain situations that warrant its use. Stay or Go is recommended in certain Australian bushfire situations where proper planning eliminates most safety risk (Bushfire CRC 2006), while some U.S. communities are beginning to promote SIP as an alternative to evacuation when wildland fire threatens WUI communities (Thorp et al. nd, Rancho Santa Fe Fire Protection District 2004, Santa Fe Fire District 2006). Professional organizations involved in wildland fire and natural resource

management have sponsored events to further the discussion about how to best protect life and property during wildfire events (National Fire Protection Association [NFPA] 2005, International Symposium on Society and Resource Management 2006, International Association of Wildland Fire 2007). In response to this increased interest, we wish to review existing literature on alternatives to evacuation during wildfire and supplement existing gaps with lessons from other hazard literatures. We will then recommend steps to improve the effectiveness of alternatives to evacuation during wildfire and introduce possible barriers to their implementation. Our undertaking here does not presuppose that the Stay or Go Model can automatically apply to wildfire in the same way shelter-in-place does in other disasters. The use of SIP during chemical spills and tornadoes is the result of numerous studies on other alternatives and specific characteristics such as ability to evacuate a disaster area in time (tornadoes) or the lack of structure damage caused in chemical spills. Research and experience also show that wildfire is a particularly unpredictable event contingent on a number of biological, physical, and social factors. Furthermore, effective protection of life and property during fire events must include active work by homeowners *both before and during the event* to reduce the chances of structural ignition *during* the fire event. Recommendations for research and managerial, community action, or experimentation will conclude our discussion.

Literature Review

Research on evacuations for public safety

Evacuation has been widely studied in the disaster field, and a common finding is the inability to evacuate safely or in a timely manner during disasters such as hurricanes and floods. For example, many residents encountered significant traffic problems while attempting to

evacuate before or return after Hurricanes Andrew (1992) and Floyd (1999) (Lindell et al. 2000, Dow and Cutter 2002). Models of evacuation behavior during the 1997 floods in the Red River Basin, Canada highlighted the importance of warning timing and the number of households evacuating in determining whether communities can effectively mitigate impact on communities during an oncoming disaster (Simonovic and Ahmad 2005).

Issues for wildland fire evacuation are the same as those for other disasters: notification, timing, evacuation of pets and livestock, ingress and egress, and people who refuse to leave or delay leaving (Carroll and Cohn 2007). Research on evacuations in the WUI also focuses on barriers to effective evacuation (Cova and Church, 1997). Cova (2005) used geographic information system modeling to argue that Western communities in areas with frequent fires often do not have sufficient traffic infrastructure to facilitate timely evacuation. He went on to suggest models that could help emergency managers identify how long it would take for communities to evacuate and their ability to do so given the proximity of the fire. These "trigger points" could help reduce conflicts during evacuation events. Wolshon and Marchive (2007) simulated traffic flow conditions in the WUI under a range of evacuation notice lead times and housing densities. To safely evacuate more people, they recommended that emergency managers (1) provide more lead time to evacuees, (2) control traffic levels during evacuations so that fewer vehicles are trying to exit at the same time, and (3) locate subdivision exits more strategically to reduce egress time, paying particular attention to the proximity and location of and the potential traffic load from feeder routes.

Natural resource social scientists have explored wildland fire evacuations in case studies of specific fire events. For example, those interviewed during a case study of the 2002 Hayman Fire (Colorado) talked about the hardships of evacuation, including the loss of income and mental

anguish. Some indicated that they would be reluctant to evacuate if they found themselves in another fire event (Graham 2003). Similar sentiments appear in research about other disasters such as hurricanes and floods (Whitehead et al. 2000; Dash and Morrow 2001). However residents involved in the Hayman Fire stated that "The shared experiences of… the evacuation process created opportunities for people to get to know each other and work together" (Graham 2003, p. 358).

More recently, natural resource social scientists have studied the impacts of wildland fire evacuation on local populations. Cohn et al. (2006) studied evacuations during three fires — the Hayman Fire, 2002 Rodeo-Chediski Fire (Arizona), and 2000 Cave Gulch/Bucksnort Fires (Montana). They found that homeowners and managers involved in wildland fire evacuations experienced conflict due to differing views of fire risk, interpretation of or access to information about fire damage, and delays in allowing residents to return to their homes. While public safety officials wrestle with how to handle people who refuse to leave, some residents who have experienced evacuation say they will stay next time. They indicated that the worst part of the evacuation process is the uncertainty surrounding the condition of their homes. Also of concern is the safety of pets and livestock. Residents see a real potential for staying behind during an evacuation (1) because they do not feel they are actually at risk, and (2) if they are at risk, they feel they can protect their homes and property.

The desire to stay rather than evacuate during a disaster has been found in studies across multiple disasters (Dash and Morrow 2001). Fifty percent of rural residents affected by the 1997 Red River Flood in Canada favored voluntary evacuations and were bitter about being forced from their homes because they were unable to establish defenses (Rasid et al. 2000). Perceived traffic delays during hurricane evacuation or return can also lead some residents to favor

voluntary evacuations or make residents more apt to stay at home during future hurricanes (Whitehead et al. 2000, Dash and Morrow 2001). The decision to evacuate or stay and defend may not be a choice for some residents—disabled or elderly populations may not always be able to evacuate during disaster situations (Lach et al. 2005). These findings show that evacuation can often create additional problems during and after disasters. Our next section will outline the current uses of shelter-in-place as a way of introducing its Australian Stay or Go Model as an alternative to evacuation when evacuation (especially last minute evacuation) would be more dangerous to residents. It also has the potential of application where the twin objectives of protecting life *and* property are best achieved by staying and defending.

Shelter-in-place as an alternative to evacuation

American experience with SIP is primarily limited to disasters of short duration such as tornadoes and chemical spills, where it has proven effective in reducing injury and saving lives (Wilson 1991; Mannan and Kilpatrick 2000). SIP is the recommended response during tornadoes because of the short warning time available during these disasters, and government specifications for tornado shelters have proven effective in reducing fatalities during the last century (Simmons and Sutter 2005).

Emergency management officials will recommend that local residents SIP during short-duration chemical spills (National Institute of Chemical Studies 2007). Research on SIP during chemical spills has resulted in decision aids outlining procedures and conditions where SIP is a viable alternative to evacuation (Mannan and Kilpatrick 2000; Raber et al. 2002), although no one aid has been widely accepted based on validity, utility, and effectiveness (Sorensen et al. 2004). These decision aids are supported by a large body of research on building standards for SIP and the dispersal of chemicals under various conditions. This research is similar to studies

on the combustibility of homes or conditions in the home ignition zone (Cohen 2000) and chemical dispersal studies are not unlike models predicting the spread or intensity of wildland fires (Kalabokidis et al. 2002, Vakalis et al. 2003). For these reasons, it seems logical to explore the existing SIP literature to advance similar concepts such as the Stay or Go Model for use during fire.

Evacuate or Not During Wildland Fire in the U.S.

No community in the United States has implemented a SIP or stay and defend plan during a wildland fire. At a recent conference in Denver, a panel discussed the decision to stay or go when a wildland fire approaches (NFPA 2005). Panel members identified problems with evacuations, including fires that prevent safe passage along planned evacuation routes, the need to move individuals who are unable to evacuate, inefficient planning, and a poorly informed public. They also acknowledged benefits of alternatives to evacuation: safer buildings for fire fighters and property owners, homeowners participating in the defense of their own homes, limited traffic on local roads allowing access by emergency vehicles, and wildland firefighting crews and equipment freed to protect natural resources.

Several communities are actively discussing plans that include the option of remaining at home or in safe zones during fire and intend to implement these if conditions permit. In Santa Fe, New Mexico, remaining in fire-hardened structure is described as a “last resort” (Santa Fe Fire Department nd). However, some experts in the Santa Fe Fire Department believe that local construction practices and the type of wildfire expected for the local types make remaining in fire-hardened structures during a fire a viable alternative to evacuation (Thorp et al. nd).

In southern California, the Rancho Santa Fe Fire Protection District is actively promoting SIP. In their literature they explain:

> *Typically, when a wildfire threatens homes, evacuations are ordered. Evacuations will shelter residents away from danger during a catastrophic event. During evacuations though, panic and chaos ensue, causing traffic collisions, blocked roadways, injuries and deaths. In fact, most wildfire-related deaths occur during evacuation efforts.*
>
> *Your community, however, is designed to shelter you inside your home, far away from these congested evacuation routes… This means that you will not need to evacuate during a wildfire. (*Rancho Santa Fe Fire Protection District 2004, p. 2*)*

The Rancho Santa Fe literature describes the local construction features that allow for SIP, outlines what a resident should do when a wildland fire approaches, and stresses the importance of maintenance as a key to preserving SIP qualities in the community. Although this idea is similar to the Stay or Go Model, it lacks the appropriate citizen component of actively defending the home in the event that residents stay during a fire event. It is also important to note that not all communities will have the resources or the community or local government standards in place to implement the ordinances and restrictions needed to accomplish planning related to the Stay or Go Model. Likewise, retrofitting existing communities is difficult. But Rancho Santa Fe does demonstrate than certain communities can implement the physical components necessary for the Stay or Go Model to be effective.

The SIP standards in Rancho Santa Fe recently were put to the test during the complex of fires in October of 2007 that destroyed a number of homes in Southern California. While 55 other structures in the Rancho Santa Fe area burned in the Witch Fire, none of them were in the five communities designated "shelter-in-place" by the local fire district. Residents of these communities *were* however issued a mandatory evacuation order (Welch 2007).

We should also note that apparently not everyone in Rancho Santa Fe is supportive of the alternative to remaining in fire-hardened structures during fire events approach—a local website charges that "The County has officially decided to leave children behind in a wildfire" (llcfire 2007). This is indicative of our larger claim: that it is ultimately just as important to create a social infrastructure, increase citizen knowledge and procure their support for alternative strategies. For Rancho Santa Fe fire officials, the option of remaining in protected structures during fire events is "a modern approach to living safely in a woodland-urban interface community" (Steinberg 2005).

Recommendations

> *But there is too much government intervention in our lives. And that is the same way with my house. If I want to defend my house, that is my right as a U.S. citizen and homeowner to defend my property. So, if that meant staying behind or being able to go out for a couple hours in the morning and dropping a few trees, I should have been given the right to do that.* (Colorado resident quoted in Cohn et al. 2006, p. 43)

Evacuation will likely continue to be a frequent response to disaster situations such as wildland fire. However, any uniform disaster response is too simplistic to apply to varied fire situations influenced by vegetation, geography, community infrastructure, and the social context. SIP has a long and proven history in disaster situations such as chemical spills and tornadoes, the Stay or Go Model is being applied under certain bushfire conditions in Australia, and both are being considered in the U.S. for use in wildland fire situations. In the following sections, we present recommendations that could move forward the study and implementation of the Stay or Go Model. We realize that the potential actions imbedded in the recommendations we are about

to make need to be carefully thought through before being applied in any given situation (McCaffery 2007). They are offered as a means to stimulate discussion, additional research and hopefully some careful, real-world experimentation.

Recommendation #1: Adapt tools and practices from other disasters for use during wildfire situations

Evacuation trigger points, developed for use in hurricane events, have been successfully adapted for wildland fire. For example, multiple evacuation trigger points were employed during the Hayman Fire (Graham 2003). Similarly, the decision aids used to determine SIP viability during chemical spills could be adapted to wildland fire situations. Checklists, decision trees, and detailed analyses have all been used in decision-making regarding evacuation or SIP for chemical spills (Sorensen et al. 2004). Adapting these decision aids for the Stay or Go Model used in wildland fires would establish common procedures while allowing for local differences.

Recommendation #2: Build an understanding of the social knowledge and organization needed to support alternatives to evacuation.

We know the construction characteristics that support the Stay or Go Model, including construction with fire-resistive materials, boxed eaves, residential fire sprinklers, "Class-A" non-combustible roofs, dual pane or tempered glass windows, and a well-maintained, fire-resistive landscape (Rancho Santa Fe Fire Protection District 2004). We don't know the social elements that need to be in place, including stakeholder relationships and education programs. Sorensen et al. (2004) discuss the importance of different emergency planning elements informing decisions on evacuation and alternatives such as the Stay or Go Model. However, we would expect that

there are also different levels the networks and relations that allow groups of stakeholders to work together to accomplish goals (Flora 2003) and that will influence the successful implementation of the Stay or Go Model. For example, one element of community capacity is social capital — the networks and relations that allow groups of stakeholders to work together and accomplish goals (Flora 2003). We would expect that a high level of social capital would need to be employed to implement any alternative to evacuation during wildland fire. Social scientists can identify the critical social characteristics for SIP or the Stay or Go model and how these characteristics can be developed or enhanced in communities.

Recommendation #3: Explore how organizational structure and culture influence adoption and use of management strategies such as the Stay or Go model.

Successful implementation of alternatives to evacuation will necessitate an increased understanding of the way new ideas spread within organizations responsible for fire management, and how different organizational cultures influence the implementation of alternatives such as leave early or stay and defend. Organizational culture is an important component in the implementation of the type of decision-making inherent in the Stay or Go Model (Kaufman 1960). Studies indicate that federal, state, and county land management agencies maintain shared cultures, socialization practices, and strict adherence to established practices to facilitate consistent behaviors among geographically dispersed managers (Davenport et al. 2006). This can be especially important when innovations such as the Stay or Go model conflict with previously-held beliefs by those managing public safety— in some cases threatening officials' views about their role in disaster mitigation. Thackaberry (2004) suggests that creating organizational cultures which encourage local officials to make adaptive decisions about public safety can reduce these issues (Thackaberry 2004).

Resistance to new strategies in disaster mitigation can also stem from a fear of accountability. As Davis (2006) indicated in his content analysis of *The New York Times* stories about wildfire, managers' administrative shifts are often driven by media attention or public outcry about current management strategies. Similarly, studies of various hazard managers show that personal accountability is a major concern and may influence their willingness to advocate more adaptive decisions such as SIP (Denis 2001). As Crichton et al. (2005) point out in their study of decision-making among on-site incident command personnel at nuclear reactors, these considerations include evaluations of uncertainty and available procedures.

Recommendation #4—Develop and test different approaches to education and communication about alternatives to evacuation.

Citizens need to understand and support the Stay or Go Model to insure successful community-wide implementation. Education is especially critical for the necessary maintenance to keep landscapes and buildings ready. Efforts to educate WUI residents about wildland fire risk and the adoption of defensible space have been widely studied (see for example Nelson et al. 2005, Monroe et al. 2006). Programs such as the multi-agency Firewise Communities/USA Program and Fire Safe Councils have been effective in providing readily accessible knowledge about reducing fire risk (Sturtevant and McCaffrey 2007). These programs provide hands-on learning opportunities which increase the adoption on defensible space practices and support for wildland fire management (Parkinson et al. 2003, McCaffrey 2004). Researchers can test the use of existing programs or create new approaches to inform and build support among local residents for SIP initiatives.

Recommendation #5: Develop collaborative frameworks and relationships that facilitate Stay or Go adoption among diverse community groups.

Perhaps the largest barrier to the implementation of the Stay or Go Model as an alternative to evacuation during wildland fire is the cooperation and coordination it requires between a diverse group of landowners, governments, land management agencies, and other stakeholders in the WUI. Collaborative planning at the neighborhood and community level has been shown to reduce miscommunication and potential conflicts about public safety by informing residents' about defensible space requirements and educating them about the precautions taken during fire, including alternatives such as the Stay or Go Model (McCaffery 2004, 2007).

The ability to reach a shared vision of appropriate actions before and during fire events through collaboration is not an easy task. For example, Monroe et al. (2003) studied collaborative efforts to create defensible space guidelines in Florida. Shared goals, communication among those creating guidelines, and the need for local knowledge in fire planning were found to be critical for collaborative action.

Collaboration is recognized as a critical component of fuels and natural resource management planning (Wondolleck and Yaffe 2000, Sturtevant et al. 2005). Yet research indicates that land-management agencies have had a difficult time fully adopting a collaborative approach to decision-making and wildland fire management (Machlis et. al. 2001, Davenport et al. 2007). Adopting alternatives to evacuation in WUI wildfire situations would require organizational change at a number of levels in federal state, county and local governments.

Conclusion

The Stay or Go Model is certainly no silver bullet for minimizing the extent of human injury and infrastructure damage from wildfire events. However, in an era of increasingly stretched

government resources, an increased emphasis on citizen agency, and greater reliance on the use of local place-based knowledge in land management decision-making, we argue the time has come to discuss openly and test alternatives to evacuation for some wildfire events. Another argument in favor of the Stay or Go model is that even in situations (i.e. such as the case of extreme fire behavior) in which the "leave early" option is ultimately followed, the physical and social preparation involved in adopting the approach will likely result in greater human safety and reduced property loss. More research and real world experience with alternatives to evacuation are necessary if we are to learn more about what is needed in terms of community preparedness and organizational coordination to realize the potential of these alternatives during wildland fire events.

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CHAPTER 3:

FANNING THE FLAMES? MEDIA COVERAGE DURING WILDFIRE EVENTS AND ITS RELATION TO BROADER SOCIETAL UNDERSTANDINGS OF THE HAZARD

Research from a number of fields has demonstrated how the news media influence broader public perception and response to hazard events such as wildfire (Eisensee & Strongberg; Freudenburg, Coleman, Gonzales & Hegeland 1996). Often this is accomplished through the selection and presentation of what news makers consider the most prominent information about an issue, providing consumers one of the many sources of narrative they draw from to discuss and collectively make sense of hazard events (Tierney, Bevc & Kuligowski 2006). Others have noted that media presentations provide consumers with central organizing ideas, thus helping them interpret, define and respond to problems in their interactions with others (Miles & Morse 2007; Kitzinger 1999).

Unfortunately, research on the mass media as an important component of public understanding/response to wildfire is lacking in comparison to other hazards. The majority of research on this topic has often focused narrowly on media presentation and/or public conception of particular fire management issues. These include prescribed burning (Shindler, Toman & McCaffrey 2009; Jacobson, Monroe & Marynowski, 2001) or policy initiatives intended to reduce wildfire risk among residents living in areas proximate to wildland vegetation (the Wildland Urban Interface) (Davis 2006; Jonshon et al. 2009).

Most fire professionals and scholars acknowledge the media as an influential force in the way the public understands and responds to wildfire events (Carroll & Cohn 2007; Pyne 1997). They also recognize the media as a vehicle to communicate fire risk information to the public

(McCaffrey 2004; Toman, Shindler & Brunson 2006). However such narratives rarely extend beyond claims that the media promote old conceptions of wildfire as the "enemy" of human settlement and the environment. In natural resource professional circles these notions have largely given way to the conception of naturally-occurring fire as a vital ecological process that can reduce the risk of catastrophic (unnaturally intense) fires and provide other ecosystem benefits (Paveglio, Carroll, Absher & Norton, 2009; Pyne 1997). Coincidently, as urban sprawl has extended farther into fire-prone environments and flammable fuels have built up in such environments, wildland firefighting (particularly that to protect human settlements) has come under increased scrutiny from residents (Thackaberry 2004). For instance a number of recent studies have documented conflict between local residents and (largely federal) fire fighting agencies during and after large wildfire events (Carroll, Higgins, Cohn & Burchfield, 2006).

Less explored are the themes or underlying assumptions in media texts that continue to reflect and promote the old notions of fire exclusion as the best way to protect both wildland resources and human settlements. This is especially important because populations at risk for wildfire fire are increasingly encouraged to take responsibility for their own residential fire protections (i.e. brush thinning, employing fire resistant construction standards) and/or collaborating with natural resource and fire professionals. Minimizing potential conflict and promoting local public cooperation and problem-solving before during and after wildfire events are significant concerns to such efforts (Daniel, Carroll, Moseley & Raish, 2007). Also missing is a more explicit recognition that the media only one of many important sources the public, professionals and policymakers use to actively create meanings for the management and mitigation of potential and actual wildfire situations. This includes the way media presentation

influences the slow change in public opinion about the natural role of fire in the ecosystem (Paveglio et al. 2009; Shindler 2007).

Our research will provide insight on the preceding issues by analyzing newspaper coverage of significant fire events in California and Washington State. We use both discourse analysis and the concept of framing in an effort to better explain how media presentations are embedded in and drawn from larger economic, social, cultural and political contexts (Fairclough 2003; Focucault 1972; 1977). This perspective allows us to discuss presentations made by the media and relate them existing social science research on public perceptions wildfire (Martin, Raish & Kent, 2008; Daniel et al. 2007). The intended result is a more nuanced discussion than is currently found in the literature concerning how media presentations reflect or are influenced by broader public discourse around wildfire. The remainder of this paper is organized as follows. First, we will review relevant literature related to discourse analysis and the concept of framing. This will be followed by a short history of fire social science and the interaction between the public and firefighting professionals during hazard events. Next, we will present the emergent themes that were evident in newspaper discourse during the Columbia Complex Fire in Washington State and the Day Fire in California, including the interaction between the local public and fire professionals. Finally, we will revisit our discussion of discourse analysis and framing in an effort to situate media discourse about fire events in broader social, cultural, political, or economic contexts.

Literature Review

Discourse analysis and framing

There are many different definitions of discourse and its impacts on social life. Discourse is most commonly understood as the patterns of spoken or written language social actors use to

communicate with each other (Fairclough 2003; Focucault 1972; 1977). Yet such "texts" are only one small portion of a very complex relationship between language, communication and the social world (Gee 1999). For one, all action (including language) is situated within particular social and historical contexts (Jorgensen & Phillips 2002; Hajer 1995). Rooted in social construction theory, discourse analysis treats explicit communication (including actions, language and written text) as the mechanisms humans use to create and renegotiate shared mental models of the world around them (Tischer, Meyer, Wodak & Vetter, 2002; Van Dijk 1997). The goal of discourse analysis is to understand how and why language use, in our case newspaper discourse, contributes to individual and collective meanings of an issue such as wildfire (Tischer et al 2002; Van Dijk 1997).

Discourse surrounding virtually any issue is often marked by competing efforts to define or "frame" a particular issue (Sonnett, Morehouse, Finger, Garfin & Rattray, 2006; Gamson & Modligliani 1989; Goffman 1974). Researchers from environmental and hazard literatures have demonstrated that how and by whom topics are framed greatly influence how the public acts toward a particular issue (Davis 2006; Entman 2004; Freudenburg et al. 1996). Defined broadly, a frame is said to enable people to "locate, perceive, identify and label occurrences within their life space and the world at large...By rendering events or occurrences meaningful, frames function to organize experience and guide action, whether individual or collective" (Snow et al. 1986 p 464). Similarly, the control, creation or modification of such frames is often cited by critical scholars as the basis by which elites' exert power over other members of society (Chong & Druckman 2007).

More recently, framing has become among the most popular approaches to understanding mass media effects (Van Gorp 2007). These studies explore how the words, images or phrases

media producers use to present unfolding events communicate different messages to an audience (Chong and Druckman 2007; Gamson & Modigliani 1989). According to Entman (1993): "To frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" (p. 52).

A number of factors lead the media to frame issues in a particular way, including source or quote selection, reporter bias, organizational routines and the influence of special interests groups (Entman 2004; Scheufele 1999). However as Scheufele (2004; 1999) and others (Kinder 2007; Van Gorp 2007) have since pointed out, journalists themselves are not immune to frames. Existing public discourse and citizen action surrounding a given issue also influence the way reporters choose to construct and frame their stories. This is clearly important to our discussion of wildfire, as the fire exclusion paradigm long promoted by the media originated in public discourse during the early part of the 20th century (Pyne 1997).

We seek to avoid a narrow or deterministic view of media effects in this research (McLeod & Detenber 1999; Neuman, Just & Crigler 1992). Rather, we see media discourse as one of many sources that social actors draw from in the creation of meaning or as the basis for action (Kinder 2007; Van Gorp 2007). Framing and discourse analysis are treated as complimentary and related theories. Framing clearly provides a way to describe the power and communicative effect of media discourse. Meanwhile, discourse analysis allows us to better understand how media presentations reflect or contradict meanings created in other social contexts. For instance, Goffman's (1974; 1981) conceptions of frames bridge the gap between media and broader society. He postulated that frames are a central part of culture that exists beyond the social actor. Often the use and familiarity with broader cultural frames in discourse

makes their influence on everyday life invisible to the general public (Van Gorp 2007; Goffman 1981).

Researchers who have used this approach to explain human experience with hazards, the environment or other social phenomenon (Sonnett et al. 2006; McLeod & Detenber 1999) focus more on the ways issues play out in what has been called the "public transcript" (Scott 1990). Others have demonstrated that the representation of environmental issues in public newspapers (a form of transcript) provide particular insight into the ways these issues are discussed in society (Norton 2008).

Media discourse and wildfire

A relatively small body of literature has consistently shown that media discourse about wildfire or its management greatly influence public conception of the hazard. For instance, news reports during the framed the 1988 wildfires in Yellowstone National Park as destructive and detrimental, leading the public to believe that the wiped out a national treasure. The truth is that fire is a natural part of the Yellowstone ecosystem—in the long-term the 1988 fires provided enhanced wildlife habitat and restored ecosystem health (Smith 1992; Reid 1989). Jacobson et al. (2001) concluded that media reporting about the benefits of prescribed fire closely matched beliefs of the public. However, the public reported much more severe risks to wildlife and neighboring property from the practice. These views are clearly the legacy of Smokey Bear, one of the most successful PR campaigns ever conducted and still the most enduring image of fire management (Paveglio et al. 2009). Though not explicitly news media, Smokey's message that fires are harmful to the forest cannot be overlooked in any discussion of media impacts. More recently, Davis' (2006) and Jonshon et al.'s (2009) research on media coverage of national fire

policy reveals that increased media attention, presentation and criticism are a major influence on public attitudes and policy shifts at the national level.

The above studies and others (Shindler et al. 2009; Toman, Shindler & Brunson, 2006) provide compelling evidence that the media is a frequent source of public information about wildfire. McCaffery (2004) found that newspapers or magazine articles were cited most frequently as a source of information the public uses to learn about various aspects of fire management. Among the more direct links between media framing and public response to the hazard is Seijo's (2009) extensive study of government, media and public framing concerning fire suppression policy in Spain. Mercer and Prisbrey (2004) study of newspapers covering a wildfire on the Hanford Nuclear Reservation in Washington State is another good example. Seijo (2009) draws clear parallels to American Forestry and its impact on the fire suppression policies that have led to increased fire risk while Mercer and Prisbrey (2004) demonstrate how local newspaper coverage promoted trust and confidence in local fire fighting authorities. Cox et al. (2006) used critical discourse analysis to show how media coverage "sequestered the suffering" of effected publics following a fire event. Finally, Whittaker and Mercer (2004) used discourse analysis to analyze media and public debate over fire policy following the Victorian Bushfires of 2003.

What seems missing from the above research is focused analysis of the underlying assumptions or themes that guide broader representations of wildfire in the media, including media coverage during and immediately after such events. Also missing is the linkage of such discourses to the broader sociological understandings that characterize the field of fire social science. Uncovering these "taken for granted assumptions" in text and linking them to broader

social, political or cultural context is something that both discourse analysis and frame analysis attempt to achieve.

Broader fire social science literature

A diverse and growing body of fire social science can add to the discussion of wildfire in the "public transcript." We wish to focus on two aspects of fire social science in this paper because they are most relevant to our discussion: (1) Efforts to change public perceptions/actions surrounding fire and (2) The conflict or cohesion between local publics and fire professionals during and after wildfire events.

Resource managers recognized the need to change public perceptions of wildfire in the 1970's. By this time the negative consequences of fire exclusion policies had become increasingly obvious (Cortner, Zwolinski, Carpenter & Taylor, 1990), including the increased intensity and prevalence of wildfire in Western ecosystems dependent on periodic burns (Arno & Allison-Bunnell, 2002).

A number of factors contribute to the ways the public perceives or acts toward the reality of wildfire risk. Some of these include the fear of escaped fires, suppression costs, and the adverse effects wildfire events may have on recreational opportunities or area aesthetics (Shindler 2007; Bowker et al. 2009). Other studies show trust in firefighting professionals, proximity to homes (McCaffrey 2008; Winter et al. 2002), or the size and origin of the fire also play a role in people's views (Kneeshaw et al. 2004). Central to these and other notions, though rarely discussed explicitly, is fact that wildfire is a significant threat to property (both structures and land). Because eliminating fire reduces the chances of such destruction in the short term, many residents remain convinced that excluding fire is the best way to protect their investments and possessions (Daniel 2007; Cohn et al. 2008).

Other research demonstrates that property concerns play a central (though not explicitly recognized) role in the relationship between effected publics and fire professionals during significant wildfire events (Loomis, Bair & Gonzalez-Caban, 2001; Carroll et al. 2005). Early disaster scholars (Quarantelli & Dynes 1976; Erikson 1976) claimed that so-called "natural disasters" more commonly brought community members together in a support network dubbed the "therapeutic community," while human-caused "technological disasters" often led to community conflict ("corrosive community"). Newer work has increasingly shown that the line between technological and natural disasters is not so clear; in many cases the processes driving the natural disaster event may be influenced by human action (Flint & Luloff, 2005; Brancati 2007). This is primarily the case with wildfire, which researchers, policy makers and professionals uniformly agree is driven by both past management practices and changing biophysical conditions (Kumagai, Edwards &Carroll, 2006; Martin, Raish & Kent, 2008).

It has become increasingly clear that wildfire events can lead to both conflict and cohesion among residents and outside firefighting agents (Carroll & Cohn 2007; Cohn et al. 2008). For instance, a study of the Rodeo-Chediski fire in Arizona indicates that wildfire can create support among local residents and conflict with fire professionals from outside of the community (Carroll, et. al. 2005). A re-study of the same communities five years later found elements of both long-term cohesion and conflict created during the event had become an integral part of the local culture and the basis by which residents would act in future wildfire situations (Carroll, Paveglio, Jakes and Higgins, in press). Others demonstrate how hazard events can amplify pre-existing social conflicts, including cultural and class disparities (Tierney et al. 2006).

Conflict during wildfire events often stems from residents' perception that standardized systems of government response (e.g., Incident Command System) fail to meet their expectations

for management. This includes the protection of property or allowing residents to return to their homes quickly after evacuation (Kumagai et al. 2006; Carroll, Cohn, Higgins and Burchfield, 2006). Such conflict can also arise when residents have unrealistic expectations for firefighting protections, and some scholars have shown how such pressures have led to the failure of safety practices surrounding wildland firefighting (Thackaberry 2004; Weick 1993). Conversely, there is evidence that allowing for resident (particularly local firefighters) input or aid in the firefighting process, providing residents with regular information about fire progression and a (sometimes implicit) focus on private property concerns can lead to cohesion during and after fire events (Sturtevant & Jakes 2008; Carroll et al. 2006; Taylor et al. 2007).

How do media representations reflect or influence broader "discourses" of wildland firefighting and management? Our intent in this research is to uncover the drivers behind media presentation of wildfire events and begin to link them with the trends documented in other social realms.

Methods

Data collection and background

This study analyzes news coverage of two fires that took place in the late summer of 2006: The Columbia Complex Fire in southeast Washington State and the Day Fire in southern California. Two fire events were chosen in an attempt to capture media discourse from different regions of the Western U.S during the same time period. We gathered articles from any regional and local newspapers covering each event to capture a broad representation of text and media discourse. This included four newspapers covering the Columbia Complex Fire and six papers covering the Day Fire. Papers ranged from small local dailies to the largest newspapers operating in the region. Relevant data include all newspaper articles, editorials and letters to the

editor concerning each fire. Coverage ranged from Aug. 22 through mid-October when crews contained most of the fires and coverage decreased significantly.

Background

The Columbia Complex Fire began after lightning struck Umatilla National Forest land on August 21, 2006. It quickly spread to private lands near the community of Dayton in southeastern Washington. At one point the Columbia Complex Fire was the number one fire concern in the nation, and included all three levels of incident command personnel outlined in the bureaucratic response to disaster situations. Crews fought the fire for more than a month until they contained it in early October. It burned roughly 110,000 acres of private and public land including National Forest, wheat fields and grasslands. During the initial growth of the fire, crews ordered the evacuation of nearly 350 homes in the area, closed off area highways, and restricted access to a large portion of the Umatilla National Forest, including the Wenaha-Tuccannon Wilderness area. Approximately 30 structures were damaged during the event, including permanent residences, vacation cabins and outbuildings such as barns. The Columbia Complex Fire cost $35 million to suppress.

The Day Fire began Labor Day (Sep. 4), 2006 after a trash fire grew out of control. It burned more than 162,702 acres, mostly in the Los Padres National Forest, and about 4,800 firefighting personnel helped contain the fire over the course of a month. This included all three levels of incident command personnel outlined in the bureaucratic response to disaster situations. The Day Fire forced the closure of significant portions of Los Padres National Forest and at one point threatened to close down the primary national highway that serves the West Coast. The fire burned 11 structures, caused 18 injuries and cost more than $100 million to suppress.

Data analysis

We used a form of analytic induction to analyze this data. Often closely tied to grounded theory and the constant comparison method, analytic induction is primarily concerned with providing data-driven explanations of phenomena that are continuously tested and modified against all available examples in a text. This approach is well suited to uncover underlying or "taken for granted" themes that are central to news discourse about fire by allowing them to "emerge" from successive rounds of coding.

Variants of analytic induction or a grounded theory approach have been used by media scholars as a form of qualitative framing analysis (Lindlof & Taylor, 2002) or by discourse analysts as a means of connecting text (sentence structure, presentation etc.) with broader discursive themes at the text or societal level (Titscher et al. 2002; Van Dijk 1997). In this case analysis was conducted using the Atlas-Ti program for qualitative data. It allowed the primary coder to make notes on each newspaper article and use them to situate portions of the dialogue into broader themes of "frames" and/or "discourse." For instance, the overall frame of a story might be labeled as "fire containment," while the specific discourse used might be identified as "containment centered on private property." Initial articles were analyzed by both the senior and secondary author in order to provide inter-coder reliability for emergent themes. Once initial themes were developed, they were tested as an explanation for the patterns in news discourse observed in each successive news article, a process referred to in the literature as progressive falsification (Strauss & Corbin 1990). Those themes or categories that did not provide a valid explanation for the news discourse in successive articles were documented and discussed with the other authors in an effort to refine or eliminate categories. Included in this consideration was the relative importance of the emergent theme and its position in the article. After the emergent themes were tested, the authors discussed how they relate to broader sociological understandings

surrounding wildfire, including their comparison to existing research on the topic. The intent here was to situate these themes within broader social, political, cultural or economic context. Finally, representative quotations of the remaining themes were gathered from all available articles and reduced to only the best examples through iterative stages of comparison.

Results

We found that issues of private property emerged as the most significant drivers behind frames of fire suppression or conflict and cohesion between local publics and external fire professionals. In the following section, we will examine how these dynamics of property play our in media discourse using three primary themes: (1) *Public lands as non-property* (2) *property as a site of cohesion*; and (3) *Property as a site of conflict*.

Public lands as a non-property

Newspaper coverage and reported discourse suggest a significant difference in conceptualization of public and private land during these two events. This includes both the impacts of the fires on each type of property and the necessity for suppression. Articles most often discussed the threat or damage each fire presented to private property prominently in the story when it was present, placing less importance on damage or threat to public land managed by the U.S. Forest Service. In the Day Fire, the size or severity of the blaze burning on public land was most often used as a vehicle to showcase the threat fire could have for human settlements. Both of these messages were linked to an underlying message of quick fire suppression. For instance, the following is an example of a common news lead during the Day Fire: "Several days of calm weather were expected to end early today, and east winds forecast at 35 to 45 mph could send the Day fire's western edge closer to Ojai, Santa Paula and Fillmore." (Saillant 2006a). Nearly all the papers covering the Day Fire event increased their coverage and

focused on efforts to protect homes when the fire began pushing in the direction of human settlements.

Media focus on the impact to private property owners during the Columbia Complex Fire resulted in omission of explicit fire impacts to National Forest land. In the Columbia Complex Fire, reported impacts often focused on structures, agricultural crops and livestock: "So far, the blaze has destroyed one home and one cabin, as well as several outbuildings, acres of wheat and has killed numerous cattle" (Hopkin 2006b). As one fire official on the Columbia Complex Fire said, "Now that it's in the wilderness, and the west edge is colder and blacker, people think the fire is out," (as cited in Ferguson 2006).

Discourse reported in the newspapers covering each fire also centered on structures and private lands damaged during the fires. Very seldom did they highlight public property impacts. As one fire manager commented during the Day Fire, "One of the good things is that it (the fire) happened in the backcountry, so there's some distance to absorb these flows and take care of some of the debris" (as cited in Biasotti 2006). Similarly, reporters from the Daily News of Los Angeles summarized the Day Fire this way:

> "The fire, still far enough from civilization, has had impacts much farther away. Choking smoke blanketed the city of Ventura when the winds shifted this weekend and residents were advised to stay inside. Last week, it was the Antelope Valley and eastern Santa Clarita Valley where ash and smoke spewed from a fire 30 to 50 miles away" (Dobuzinskis & Farrell 2006).

Thus, wildfire impacting nature was presented as less of an issue while possible impact to homes or people required additional media attention. These points are emphasized in a quote by a fire manager during the Columbia Complex fire: "If it (the fire) crosses over the draw to North Touchet it's going to be a bad scene," (he) said. "There are a lot of homes in there" (as cited in

Hopkin 2006a). Other examples include articles focusing on the detrimental health impacts of smoke from both fires, while little to no mention was made of impacts to local ecosystems.

Accordingly, newspapers focus on firefighting efforts centered primarily on keeping the fire from eventually affecting private property (specifically structures) and calling for quick suppression once threat to such property became an issue. For instance a reporter covering the Columbia Complex Fire summarized: "Crews worked to protect structures when the fire crossed the North Touchet River Road about 14 miles southeast of Dayton, fire officials said. No new damage to residences or buildings were reported this morning" (Porter 2006a). Other examples included feature stories about a family that lost their home during the Columbia Complex Fire or articles that opened by highlighting the story of one particular resident affected by the fire. Fire officials' reported efforts to protect private property such as ski resorts, private cabins or fire lookouts on National Forest Land were also frequent mentions in articles about both fires.

Another example during the Day Fire centered on the boundary closest to Interstate 5. As one newspaper reported:

> "He waved his hand over the steep, inaccessible area in the Sespe Wilderness where the fire started Sept. 4 and then spread east toward the I-5 Freeway corridor...' This is the lifeline, Dietrich said. "The focus was to keep the fire from going east." (Schoch 2006)

As a professor of fire ecology articulated during an opinion piece about the Day Fire, "The fire guys don't like it [letting fires burn on public land]... If the fire builds up a head of steam and starts going gangbusters, it could get close to an urbanized area where it's hard to stop" (Lewis 2006).

Thus, our analysis suggests that fire on public land was reported to be far less of an issue because it did not threaten privately held property, nor was there much focus on fire as a natural part of the local ecosystem. Instead, fire was treated as something to "fight" so that it did not

impact private property. As one reporter summarized, “Even the Day Fire, the season’s biggest, burned mostly brush and light timber” (Martin 2006).

Recognizing that newspapers and quoted discourse (from both citizens and firefighting professionals) emphasized private property as a larger focus in the mitigation of these fire events, we intend to explore how these dynamics bear upon conflict and cohesion between locals and external fire fighting professionals.

Property as a site of cohesion

When fire fighting professionals and local residents came together during the Columbia Complex and Day Fires, reports from both fires suggest that each group seemed to expect the other to adopt or recognize their values and roles. For residents this included a focus on their concerns for private property, including livelihood and emotional ties. For instance, this passage framed firefighters’ efforts to protect homes above all else, including public lands:

> Firefighters from other agencies considered the smattering of houses near Lockwood Valley Road too hard to defend against the Day fire. It looked like the blaze was going to chew up the houses and leave nothing but charred remains just as it had done to the 162,702 acres in Los Padres National Forest. However, Ventura County Fire Department firefighters were not ready to give up. "We're not going to back down to structures that are in our own county," said firefighter Matt Falat. "We are not going to lose." (Navarro 2006)

A parallel sentiment was attributed to the fire information officer for the Columbia Complex Fire, who was quoted as saying “One home is too many and we don’t like to lose any of them,” (as cited in Porter 2006b).

At the same time, newspaper articles from both fires reported that residents were appreciative of firefighters’ efforts to protect their property. As a resident reflected after the Day fire passed: “The strike team stayed with us. . . Fire commanders ‘told them to leave but they never left’” (as quoted in Saillant 2006b). Similarly, resident Betty Turner was quoted as saying

after the Columbia Complex Fire, "The wonderful firemen had our pictures out on the lawn in a garbage can," … The firefighters had gathered the Turners' pictures off the walls. When the Turners arrived they helped them gather important papers, and items they didn't want to lose" (as cited in Chicken 2006a).

In the end, newspapers covering both fires reported that suppression efforts were a success and that the local community was supportive of their efforts. This conclusion was reached in the Day Fire because, as reporters summarized, after four weeks there were "no injuries or significant losses" (Aidem 2006), and that "damage to property was relatively light" (Martin 2006). A number of papers ran editorials praising firefighting efforts including a passage similar to this one: "Efforts to keep the fire from jumping into populated areas were very successful, with just one home and a handful of outbuildings destroyed...All sights firefighters have once again earned this community's confidence and gratitude (Ventura Country Star 2006)."

Similarly, one newspaper covering the Columbia Complex Fire presented the success of fire suppression efforts in the following way: "Firefighters have managed to save all but one permanent residence -- the home of Lester and Jana Eaton, a historic, three-level home on Crall Hollow. In comparison, last year's School Fire destroyed more than 300 homes, cabins and outbuildings" (Hopkin 2006c).

Firefighters' acknowledgement of private property was not limited to the actual performance of protecting property while suppressing the fire; in the Columbia Complex Fire such attendance also included an explicit acknowledgment of property concerns in information sessions. As Chicken (2006b) reported about outreach efforts during the Columbia Complex

Fire, “most of the more than 200 people at the meeting seemed satisfied with information provided and the opportunity to meet with fire officials.”

The added benefit from this attendance to property concerns on the part of agency personnel was that local residents seemed more apt to adopt the agency view on fire issues. This presentation was evident in this quote from the Columbia Complex Fire:

> “[resident name] [coming to] appreciate the firefighters, who have checked on him regularly. And he realizes the fire managers have a ‘strategy that is thought out. It is not emotional like it is for people like us that have property. They see the bigger decisions that have to be made’” (as cited in Chicken 2006c).

Thus articles from a variety of newspapers covering both fires seemed to suggest that agency willingness to protect private property first and to communicate about property concerns builds mutual trust and understanding between local populations and external actors (i.e. firefighting personnel, public safety officials).

Property as a site of conflict

The bulk of newspaper reports from both fires indicated the predominance of cohesion among the local public and firefighting professionals. However, some concerns and conflict about firefighting management also emerged during the Columbia Complex Fire. This conflict between agency personnel and local populations was reported as the latter’s lack of confidence in the former to adequately protect private property. As one resident was quoted during a meeting with officials during the, “Why didn’t you attack the fire at the beginning?” (as cited in Chicken 2006b). Reported opposition arose as agency management limited residents’ access to protect their property. As the president of the Columbia County Cattleman’s Association was quoted as saying “ranchers aren’t being allowed reasonable access to get their cows out of danger either. This is our livelihood” (as cited in Hopkin 2006a).

Another example of firefighting efforts falling short of residents' expectations during the Columbia Complex Fire was one frustrated resident quoted as saying, "I'm out there dozing, we lose our power, so I can't pump water, they won't let my water truck past the roadblock, and those guys (firefighters) are sitting on their butts" (as cited in Hopkin 2006d). More often than not, such frustration arose because, as one reporter summarized, locals thought that "the response to the fire wasn't aggressive enough and complaining that in many cases, homeowners weren't allowed to get to their homes to try and save them" (Hopkin, 2006d).

Discussion

Our results demonstrate that concerns about private property protection and the treatment of public lands as a "non-property" are important underlying themes (or frames) in continued media discourse about wildfire. More specifically, they contribute to the framing of wildfire as a harmful event which needs to be suppressed or excluded. What remains unclear is whether the media is merely reflecting broader discourses about wildfire or influencing public opinions through their framing. By comparing the above results with existing social science research on fire, we will suggest that these elements are mutually reinforcing—that is, the media not only draw from existing public discourse in producing their news stories, but they also perpetuate outdated ideas of fire exclusion through the promotion of private property as the primary concern during fire events. Similar conclusions from mass media research support this finding (Schefele 1999; 2004; Kinder 2007; Van Gorp 2007).

Comparison of our results to fire social science literature reveals that many of the underlying conceptions in media presentation match with positions articulated by the broader public. For instance, fear that wildfires will impact private property, including the adverse effects fire could have on property aesthetics, are frequently mentioned by residents in studies of

wildfire perceptions and in the media discourse analyzed as part of this study (Shindler 2007; Bowker et al. 2009). Other examples include resident and media focus on the proximity of the fire to homes, fire size and origin (McCaffrey 2008; Toman et al. 2006; Winter et al. 2002).

Similarly, our results suggest that media discourse uses property as a focal point in the presentation of wildfire as something we need to "fight" and suppress. This is especially true when wildfire threatens human settlement or property. In this respect the media continues to be one of many sources the public draw from in replicating the old notions of fire exclusion. Meanwhile, prevailing scientific evidence suggests that the public should be adapting to fire as a natural, cyclical event in WUI communities. While we cannot be certain how influential media discourse is on public resistance to fire as a natural event, previous work shows that newspapers are an influential source of information about wildfire (McCaffrey 2004; Shindler et al. 2009). For this reason, additional studies should evaluate attitudes toward fire by using media usage as an independent variable.

The dynamics of conflict or cohesion we uncovered in this study are remarkably similar to broader discourses on the subject. Cohesion was presented as occurring when firefighters recognized (whether explicit or not) that private property was of utmost concern and/or took the time to share information with the public (Sturtevant & Jakes 2008; Carroll et al. 2006). In the case of the Columbia Complex Fire, this meant regular information meetings or explicit communication that let residents know how much they wanted to keep the fire from impacting private property. In the Day Fire, cohesion emerged primarily because firefighting efforts kept the blaze from forcing interaction between residents and firefighters. The Day Fire seldom threatened private property and it burned mostly in the Los Padres National Forest. Reporters acknowledged that fire officials quickly established communication and interaction with private

landowners in the few occasions when the fire did threaten private property and pooled the majority of their resources to reduce or prevent further need for interaction.

Any conflict during the Columbia Complex Fire was presented as occurring when outside agents (e.g. Incident command teams) did not meet residents' expectations that private property should be protected at all costs. It also occurred when professionals failed to keep the fire from placing private property at risk. This included not being aggressive enough with their fire suppression efforts or ignoring residents' efforts to help put out the fire (either through actions or the sharing of knowledge). Similar conclusions have been clearly articulated in sociological studies of fire events and thus proven in broader discourses (Kumagai et al. 2006; Cohn et al. 2008).

A number of discourse analysts have stressed that the elements missing from text can be just as telling as those that were included (Huckin 2002; Tischer et al 2002). These "textural silences" are also important to meaning creation in that their omission does not provide social actors all the information possible on an issue. In the case of the media coverage surrounding the Columbia Complex or Day fires, coverage rarely mentioned the additional risk residents put themselves in by choosing to live in the WUI, nor did they make much mention of the protective actions residents could have undertaken to reduce the chance that their property would be damaged by the fire.

These omissions do not reflect broader discourse about wildfire. For one, efforts to educate the public (and particularly WUI residents) about the importance of fire in local ecosystems or how to protect themselves from wildfire damage continue to be promoted by a number of federal and local agencies. These messages are a vital part of broader discourse about

fire, as evidenced by the creation of national and local policies designed to reduce wildfire risk (Davis 2006; Paveglio et al. 2009.)

We feel the above omissions are best explained by media producers' need to draw from the dominant discourses (or frames) of their readership. In this case, it would be insensitive to point out how apathy or misunderstanding of fire processes could have increased fire risk. While the causes of this increased fire risk are actually quite complex and included both biophysical and anthropogenic factors, residents are often portrayed as victims of a "natural process" that is inherent in their locality. Threat to private property is focused upon for a similar reason: Americans have become increasingly intertwined with their physical setting and the power ownership imparts (Carruthers & Ariovich, 2004; Raymond 2003). Assuming that the U.S. government would not do everything possible to protect private property from wildfires, despite the level of personal responsibility (or irresponsibility) in that process seems contradictory to public expectation. The great irony of this logic has been pointed out by those who question why agencies such as the U.S. Forest Service spend much of an estimated $1.5 billion fire suppression budget protecting private landowners when it is not within their agency mandate (NIFC 2009; USDA 2006).

Conclusion and Recommendations

We feel that this research can provide important insights for both media producers and fire managers. For one, it recognizes the need for increased scrutiny surrounding the way the media report on wildfire events. Nor is this scrutiny restricted to newspapers, as the standards for media reporting across all mediums (Internet, television, and radio) share common frame-building properties (Entman 2004). Changing the presentation of wildfire events in the media means encouraging journalists to focus at least some of their discourse on the role of personal

responsibility among populations who choose to live in fire-prone areas. By this we do not mean to suggest that the media should stop writing about the possible or actual impacts of a wildfire on private property, but they should strive for the objectivity in perspectives they often over-emphasize in other stories.

The media should be educated to ask broader questions regarding wildfire, not just those that seem immediately relevant. For instance, reporters could ask fire managers about the measures homeowners have taken to reduce their risk ahead of the fire and how they aided firefighting efforts. They could also report more thoroughly on wildfire impacts to public lands, including possible benefits, economic losses and the severity of such events relative to "natural" fires.

Accomplishing a shift in media "frame building" also means more input from scientific and professional communities. More specifically, these populations need to be more vocal about the somewhat one-dimensional nature of media reporting during or immediately following wildfire events. Incident commanders or public relations officers assigned to fire events can use their frequent quoting in the media to shift dialogue about fire. Agencies could also provide information or workshops with media producers in an effort to foster collaborative partnerships that better reflect the "era of fire inclusion."

Whether presented as the valuable commodity that wildfire could destroy, the reason fire suppression is necessary, or the primary focus of relationships between the public and fire officials, notions of property need to take a central role in the understanding of fire events. This includes increased efforts to explore how notions of private property (including property rights) interact with messages of personal responsibility for wildfire protection. Although research

addressing these topics does exist, they are rarely treated as primary component of fire perception and action as we have seen in this research.

Our findings also have additional practical and critical implications for fire managers. First, media framing of public lands as a non-property and the high likelihood that this perception is shared by the public is important. It implies that the public is growing even more apathetic about the management and stewardship of public lands such as National Forests. Apathy about public lands also could have negative implications for future fire management. For instance, WUI residents with a perception of public lands as a non-property would presumably be less likely to support the expenditure of federal funds on fuel-management strategies.

On the other hand, fire managers would do well to use the concept of property as a means of connecting to local residents' interests. That is to say, fire managers could use the possible impact of wildfires on property as a means to motivate personal protective actions for fire. "Re-framing" public lands as a property we all share or as the source of catastrophic fires that could impact private property could also reverse the conception of public lands as a non-property. Research indicates that making fire risks tangible to residents through visual or data-driven scenarios is one possible way to achieve this (Toman et al. 2006).

Finally, face-to-face communication or dialogue between residents and fire professionals during or after fire situations can reduce possible conflict (Taylor et al. 2007). Increased communication between the local public and firefighting professionals would also allow residents time and space to articulate their stake in the planning process, thereby reducing residents' perceptions of uniform bureaucratic management that does not integrate their concerns. As shown in fire and other literatures, resident input has the capacity to improve firefighting efforts by utilizing local knowledge (Sturtevant & Jakes 2008; Carroll et al 2006).

Conversely, residents want fire professionals to couch additional communication about fire management techniques in terms of property concerns.

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CHAPTER 4:

ADOPTION AND PERCEPTION OF SHELTER-IN-PLACE IN CALIFORNIA'S RANCHO SANTA FE FIRE DISTRICT

"We don't have enough resources to put an engine at every house in harm's way. We figure, if people are going to stay, maybe they can become part of the solution." –Ventura County, California Fire Chief Bob Roper (Saillant 2009)

"*Hearing anyone suggest that homeowners should not get out of harm's way is appalling. Hearing a public safety professional make the suggestion is shameless. Stay-and-defend is clearly a half-baked idea from people who believe that saving money is more important than saving lives." –Harold Schaitberger, the general president of the International Association of Fire Fighters (IAFF) (Schaitberger 2009)*

The most fundamental decision any local resident faces in the event of a wildfire threatening his or her neighborhood is whether to flee (evacuate) or stay and ride out the event. Each choice has its risks and potential benefits. For at least 50 years, the general policy of U.S. civil authorities and public safety officials to evacuate local residents has been based on the presumption that evacuation is the safest choice in any circumstance when a wildfire threatens (Pyne 2001). Recently however, questions have been raised about whether evacuation is always the safest alternative both in terms of protecting human life and secondarily, protecting property (International Association of Wildland Fire 2007; Firewise Communities Program 2006). Evacuation itself can be dangerous, as evidenced by a recent analysis of the 2003 Cedar Fire in southern California which concluded that almost all 22 civilian deaths occurred *during* evacuation (Mutch 2007).

Protective strategies and fire management tactics in the United States allow for consideration, under some circumstances, of "alternatives to evacuation" (McCaffrey and

Rhodes 2009; Paveglio et al. 2008), but as the quotes at the beginning of this article demonstrate, there is little agreement on a universal policy. Alternatives to evacuation generally include an option for remaining in ignition-resistant structures while the flames pass, provided that building construction and vegetation management (natural and ornamental) reduce the likelihood of that structure catching fire (Rancho Santa Fe Fire Protection District 2009*a*; Paveglio et al. 2008). Understanding that wildland fire will continue to threaten property and that a growing number of residents will continue to live in the wildland-urban interface (WUI), the area where human settlement is juxtaposed with wildland vegetation, many fire professionals and residents are beginning to consider alternatives to evacuation during fire events. Yet there is clearly resistance to implementation of these new ideas in the professional and public spheres. Our goal in this paper is to present the first empirical, case study-based research in the U.S. focused specifically on the debate over the use of alternatives to evacuation. In this context we will explore factors influencing professionals' and citizens' support for the development and implementation of these strategies. We will also investigate the role for alternatives to evacuation in protecting the public from wildfire.

While wildfire events are growing in relative magnitude across areas of the U.S., they are not a particularly new threat. What has and will continue to change, however, are the ways Americans deal with wildfire threats in an age when fire is recognized as an important and natural part of many wildland ecosystems. U.S. policy has historically mandated the exclusion of fire at all costs to protect American safety and property, along the way creating the largest fire fighting system in the world (Pyne 2001). It is now generally accepted that the exclusion of fire from U.S. wildlands, particularly in the dry land ecological types that encompass much of the Inland West, has resulted in fuel build-up and much more severe and destructive fire events

(USDA and USDI 2009). This exclusion, coupled with the potential impacts of global climate change, has led people in many localities to conclude that land management needs to consider fire as a stochastically predictable cyclical occurrence rather than a rare event (Arno and Allison-Bunnell 2002). Likewise, there is increased recognition of the responsibility of WUI residents to learn to live with fire. This means that they, along with fire and land managers, must assume responsibility facilitating fire management in and around residential areas rather than assuming it can always be prevented (Jakes et al. 2007*a*, 2007*b*).

These realizations are positive steps, yet they alone cannot reduce the risk posed by destructive WUI fires that show no sign of abating. More than 85,820 fires burned nearly 9.3 million acres and destroyed 5,326 structures in 2007, part of an upward trend since 2000 in damage caused by wildfire events (National Interagency Fire Center 2009). Paired with this is the growing evidence that many Americans, especially the growing population living in or moving into the WUI, might not be able to evacuate from fire in time to avoid harm, potentially exposing them to more extreme risk as they flee the flame front (Cova 2005). Evacuations also can be extremely disruptive socially, often creating considerable uncertainty among residents who are forced to evacuate quickly and remain at shelters or with family for undetermined amounts of time (Carroll et al. 2006; Cohn et al. 2006).

Experience and research in Australia and the U.S. has demonstrated that home ignition often occurs as a result of falling embers preceding or following the main flame front (Cohen 2000). Such embers can be easily dealt with well before structural ignition if someone is present to take action and when the structure is prepared to withstand this type of ignition. The Firewise Communities Initiative and National Wildfire Coordinating Group now refer to “reducing wildfire hazards in the home ignition zone” rather than creating “defensible space,” an evolution

in thinking about why residents need to take responsibility for reducing risk on their properties. The development of alternatives to evacuation is one element in responding to the above understandings. Alternatives to evacuation make up a broad category of current and potential practices which have yet to be standardized in the U.S. (McCaffrey and Rhodes 2009; Paveglio et al. 2008). Two alternatives that have received perhaps the most attention among wildfire and public safety professionals are the "stay and defend or leave early" (SDLE) approach and "shelter-in-place" (SIP) (both defined below). Both strategies attempt to improve the safety and well being of residents during a fire by allowing them to remain in their homes and/or protect their belongings

The case study reported here is based on the analysis of nearly 80 interviews with a variety of fire professionals and managers in the San Diego area and residents of five communities in the nearby Rancho Santa Fe Fire Protection District (RSF District). The goal was to gauge their understandings and perceptions of alternatives to evacuation. The RSF District's educational material and reports in local media represent these communities as some of the first and most advanced U.S. efforts to develop alternatives to evacuation for resident safety and to further reduce devastating property damages. Current conditions in the five housing developments designated SIP by the RSF District represent years of work by area professionals to develop strict building, zoning and vegetation management standards surpassing even the advanced safety codes now mandated throughout the fire-prone San Diego area. Planning for these communities includes the option to shelter-in-place, a somewhat passive alternative in which residents could remain in their ignition-resistant homes and developments while the fire passes.

Literature

Alternatives to Evacuation

Alternatives to evacuation during wildland fire take different forms depending on the local context, and in particular, the policies and perceptions of managers in that location. American notions of alternatives, though in their formatives stages, retain influences from sheltering procedures during other short-term disasters such as tornadoes and chemical spills (National Institute for Chemical Studies 2009; Mannan and Kilpatrick 2000) while borrowing heavily from the much more well-developed Australian SDLE model. The latter version evolved specifically in response to Australian bushfire situations (Handmer and Tibbits 2005; Tasmania Fire Service 2009).

As evidenced by the relative paucity of U.S. communities with policies that include alternatives to evacuation, it appears that it is still considered "fringe thinking" by the majority of residents and managers in this country (McCaffrey and Rhodes 2009; Paveglio et al. 2008). Yet certain communities in the fire-prone American West in particular have begun to consider and implement their own versions of alternatives. Some, like the Painted Rocks Fire Department in Montana are attempting to adopt the Australian SDLE approach (McCaffrey and Rhodes 2009). Other fire districts such as Rancho Santa Fe, California (Rancho Santa Fe Fire Protection District 2009*a*) are at various stages of considering or implementing a SIP approach by mandating ignition-resistant building materials, creating buffer zones around communities with little to no fuels and regulating what residents plant near their homes to reduce the probability of structural ignition. In other communities such as Bend, Oregon, attempts to introduce alternatives have

resulted in retention of evacuation as a primary option and recognition of SIP a last resort if residents are trapped in their homes (Project Wildfire 2009).

The primary difference between the SIP and SDLE approaches is the level of resident involvement before and during the hazard event: the former is a passive process during which residents take refuge in homes during the entire duration of the fire while the latter is a multi-stage process in which neighborhood standards of the SIP process *and* resident efforts to combat fire are both needed to ensure human safety and structural protection (Paveglio et al. 2008).

There is a robust literature documenting the progression of Australian thinking regarding residents' roles during a bushfire (Handmer and Tibbits 2005; Tasmanian Fire Service 2009). For instance, mention of situations where staying in homes while a fire passes could have saved lives appears in literature as early as 1939. The concept gained serious consideration following the deaths of 83 people in the 1983 Ash Wednesday Fire. Research on this bushfire (Wilson and Fergeson 1984) and further inquiries following other significant fire situations (Parliament of the Commonwealth of Australia 2003) codified what is now the SDLE policy, also referred to as the "stay or go" model in Australia (Rhodes and Handmer 2008). The Australian model strongly encourages residents to be prepared for the fire and *actively* defend their property, a practice exemplified by the adage "houses protect people and people protect houses" (Bushfire CRC 2006). The Australasian Fire Authorities Council accepted the SDLE model and released materials on the preparations necessary for resident safety (Bushfire CRC 2006; Australian fire Authorities Council 2005). However, the concept was not met with universal acceptance, success or understanding (Tibbits and Whittaker 2007). For instance, researchers have identified a gender divide in acceptance of the practice and different conceptions among those with

families. Women and families are more likely to favor evacuation, with able-bodied men the most common family members that might stay to defend property (Proudley 2008).

Revision of the SDLE policy is occurring in the wake of the February 2009 "Black Saturday" fires in Australia. The Royal Commission convened to review conditions surrounding the fires concluded that 173 people died, with 113 of these found inside their homes. However, evidence about the actions and intensions of those who died is still preliminary (i.e. whether they had made the choice to stay and defend or were trapped by the fire). The Commission's review of "Stay or Go" concluded that information central to the policy (i.e. when to evacuate, adequate protections) was not detailed enough to ensure the safety of residents (Teague et al. 2009*a*). Recommendations from the Commission include revision of the above materials, a reinforcement that "the safest option is always to leave early rather than stay and defend," and additional professional authority to advise residents on the "defendability of their homes." The creation of an additional fire danger rating beyond "extreme" was recommended to reflect the extraordinary conditions (i.e. weather and dry fuels) which fed the Black Saturday fires, with residents strongly advised to evacuate on "catastrophic" days regardless of their plans to stay and defend. The first use of the "catastrophic" or "code red" warning occurred in November 2009 (British Broadcasting Corporation 2009). The Royal Commission also recommended that incident commanders be granted additional responsibility to order evacuations when they feel conditions are too dangerous for residents. Recommendations concerning community refuge areas or private "fire bunkers" emerged as one of the few conclusions that may advance discussion of alternatives to evacuation (Teague et al. 2009*a*; Teague et al. 2009*b*).

Increased Interest in Alternatives to Evacuation in the U.S.

In recent years, a number of U.S. symposia and conferences have featured discussions of what role alternatives to evacuation might play in WUI fire management (International Association of Wildland Fire 2007; International Symposium on Natural Resources and Society 2006; Firewise Communities Program 2006). The overall tenor of these discussions has been the same: there is significant evidence that alternatives to evacuation need to be considered given (1) advances in fire-resistant materials and understanding of home ignitability (Cohen 2000) and (2) the poor evacuation capacity in the WUI (Wolshon and Marchive 2007; Cova 2005). Research has helped reduce the risk to WUI populations by supporting the development of fire safe standards for vegetation management around homes, increased ingress and egress from communities at risk for fire, and improved building construction (i.e. fire-resistant roofing materials and proper venting, stucco or concrete sided walls, boxed eaves) to prevent structural ignition by embers or radiant heat. Increased predictive capacity and planning tools (i.e. "trigger points") for understanding fire risk (Cova et al. 2005) are another important aspect in mobilizing WUI populations at risk, as is the desire of residents to remain given negative evacuation experiences (Graham 2003).

However, managers participating in the above discussions also agree that significant issues need to be addressed before implementation of these plans, and often call for a standardization of what role alternatives to evacuation will actually play in a fire event (National Fire Protection Association 2005). This includes homeowner responsibility during a wildfire, the development of agency plans, training manuals, or best practices documents and other tools, and the ability of homeowners to understand/adapt in dynamic fire situations (McCaffrey and Rhodes 2009; Paveglio et al. 2008). Recently, fire chiefs in Southern California considered adopting some version of the SDLE policy (Saillant 2009), but ultimately decided to retain focus on

evacuation as the best option for public safety (FIRESCOPE 2009). It appears that this decision was at least influenced by the 2009 Black Saturday Fires. Development and presentation of a new policy, "Ready, Set, Go!" was unveiled by fire professionals in Southern California not long after the Black Saturday Fires (Hernandez 2009). "Ready, Set, Go!" continues to focus on ignition-resistant structures and reduction of fuels in the home ignition zone. The intent is to create housing developments that can survive fires without local residents present. The policy favors early evacuation above all options and recommends shelter only when residents are trapped by fire (Roper 2009; Ventura County Fire Department 2009). It is supported in the U.S. by the Western Fire Chiefs Association (Aleshire 2009) and the International Association of Fire Chiefs (2009).

U.S. research on the applicability of alternatives to evacuation is in a relatively early stage. Paveglio et al. (2008) laid out a number of recommendations to rectify the apparent dearth of social science knowledge on issues surrounding alternatives, including how organizational structure and culture influence their adoption or use, and the role of education and collaboration in facilitating large-scale implementation that will better protect homeowners. McCaffrey and Rhodes (2009) and Stephens et al. (2009) have explored the applicability of Australian alternatives to evacuation in the U.S. All seem to agree that alternatives to evacuation practiced in other countries cannot be imported carte blanch, and that significant work remains to be done in adapting alternatives as protective measures for U.S. populations.

Structuration Theory

It is clear from the above discussion that alternatives to evacuation can be considered a new innovation that different institutions, organizations, and governments are considering

adopting. As such, classic diffusion of innovation theory and its focus on the outcomes of new advances (Rogers 1962) could offer some insight as to why alternatives to evacuation face challenges in wide-spread adoption. However, the theory of innovations cannot describe all the interacting structural factors which determine when and why some groups or individuals adopt new strategies. Because wildfire management involves a variety of organizations with different rules and resources for action, a study concerning the adoption of an innovation, such as alternatives to evacuation, would need to account for these differences.

Giddens' (1984) structuration theory attempts to span the apparent gulf between organizational structure and action (agency), by postulating that rules and resources (structure) both enable and constrain the actions (agency) of social actors and organizations. Action is facilitated or limited when organizations and their members replicate an established structure across time and space or alter those structures through practice. Giddens defines rules as the "techniques or generalizable procedures applied in the enactment/reproduction of social practices" (Giddens 1984, p.21) and divides resources in two categories: (1) allocative (control of material resources) and (2) authoritative (control over persons, including power dynamics). In the case of wildfire and firefighting organizations, examples of rules include the standardized tactics employed to suppress fires, memorandums of understanding among firefighting agencies and the chain of command during large events (i.e. Incident Command System). Likewise, each of these agencies employs a variety of allocative resources (i.e. engines, hoses, personnel) and authorative resources (i.e. control over residents under their protection including recommending mandatory evacuations and enforcing fire codes).

Giddens' (1984, 1991) recognizes that actors and organizations are knowledgeable of the social conventions, roles and relations necessary for achieving goals and objectives, whether

consciously through experience or subconsciously through daily routine. Much of this learning stems from the ability of human beings and their institutions to reflect on their actions, the consequences (intended or otherwise) of those actions, and the structures inherent in societal functioning. In wildfire management, learning is perhaps most visible during post-incident reviews. Giddens' "institutional reflexivity" refers to the constant filtering-back of expert theories, findings and concepts to the larger public (Giddens 1991). Firewise, the International Association of Fire Chiefs and the Joint Fire Science Program are examples of institutions that attempt to facilitate the reflexive exchange of wildfire management information among experts, government and the public.

Structuration theory continues to gain attention as an approach for understanding and interpreting innovation in organizational and institutional contexts (Dougherty 2008; Edwards 2000). The theory can be valuable for understanding the adoption or non-adoption of alternatives to evacuation, as adoption is the result of individuals and organizations modifying established practices, rules or understandings through interaction in a social network that encompasses their environment, history, cultural systems and broader political context (Carroll et al. 2006). We contend that the use of structuration theory to explain the adoption of new protective strategies can facilitate hazard management by providing a more detailed identification and interpretation of the way social processes support or detract from the implementation of some practices over others. Thus, using the principles of structuration theory, this study investigated how the emergence and acceptance of alternatives to evacuation are constrained and enabled by existing structural factors (including prevailing opinions and institutionalized practices among public safety officials) and the affected public.

Methods

Site Selection

Selection of a research site for the investigation of alternatives to evacuation meant first attempting to identify all U.S. communities considering or implementing such practices. We did this by contacting national and regional professionals who are aware of such communities and searching the Web for outreach materials or news stories indicating the consideration of alternatives to evacuation. These searches resulted in a fairly short list of communities. The communities on this list were further evaluated by the authors using a number of factors, including: (1) how far along the community was in actually implementing the alternatives (rather than just expressing interest); (2) the level of professional and resident involvement in the project; and (3) whether the study site represented a WUI community. The first of these considerations was the most important, as we needed a community that was far enough along in implementing alternatives to evaluate whether the alternative could be used effectively, what barriers (if any) were impeding progress and what could be improved upon.

We made contact with representatives from five communities that satisfied the above criteria. It is important to note that in almost all of these cases only specific housing developments within the larger community were investigating or implementing alternatives. The five RSF District communities designated SIP emerged as the best choice for study because they appeared to have implemented their alternative to evacuation—shelter-in-place. Evidence supporting this perception included code and building standards satisfying the physical components of SIP, a policy directive outlining the purpose of SIP for homeowners, education and outreach efforts meant to inform homeowners as to their role in SIP, and discussion in the media about the SIP designation. The RSF District appeared to be far enough along in the

process of implementing an alternative that we could examine the process and draw lessons for other communities considering implementation of alternatives to evacuation.

The RSF District lies about 30 miles northeast of San Diego and covers approximately 42 square miles (Rancho Santa Fe Fire Protection District 2009*b*). It contains a variety of older and newer housing developments, with the five newest—The Bridges, Cielo, The Crosby, 4S Ranch and Santa Fe Valley—designated as SIP due to developer and resident implementation of measures that go beyond the International WUI, California and County of San Diego fire codes. Included in the RSF District codes are the requirement for residential fire sprinklers in every home, yearly inspections of properties to ensure that vegetation management is maintained, and homes constructed with the most ignition-resistant construction features (i.e. roofing and wall materials) (Rancho Santa Fe Fire Protection District 2009*b*). Satisfaction of these stricter RSF District codes is required to build or develop in the District boundaries.

The families in the RSF District are much more affluent than the average WUI family in the U.S. According to U.S. Census figures released in 2003, Rancho Santa Fe was the wealthiest town in America with more than 1,000 households (U.S. Census Bureau 2003). At the time of this study, it was common for housing prices in the RSF District to top $1 million. In addition, four of the communities in the RSF District (The Bridges, Cielo, The Crosby, and Santa Fe Valley) are gated developments with restricted public access.

Data Collection

Data were gathered using semi-structured, face-to-face interviews following an analytic induction approach (Glaser and Strauss 1999). Analytic induction is ideally suited to studying the development of social phenomenon such as SIP or other alternatives to evacuation because it

allows for the identification of patterns and themes surrounding concepts that have received little empirical attention. Data were collected until observed patterns stabilized and no novel information was forthcoming from additional observations (Glaser and Strauss 1999).

A combination of purposive and snowball sampling was used to select research participants for this study (Lindlof and Taylor 2002). Both methods were necessary as we wished to interview (1) a broad cross-section of people who represent the variety of local stakeholders affected by shelter-in-place policies and (2) key informants and professionals with specialized knowledge concerning the development and implementation of alternatives. Special care was taken to select professionals involved in all aspects of the planning, regulation and implementation of SIP across multiple levels of governance, even those without direct impact on RSF District policy. This allowed us to investigate not only the development and implementation of SIP in the communities selected here, but its expansion to other residential areas. Key informant residents (i.e. homeowner's association presidents or committee members) suggested additional contacts among residents with different opinions on SIP and levels of participation in the community.

The senior author conducted a total of 77 semi-structured, face-to-face key-informant interviews in the study area during July and August of 2007. Twenty-nine of these interviews were with local and regional professionals involved with fire management and 48 were with residents in four of the five communities designated SIP (Cielo, The Crosby, 4S Ranch and Santa Fe Valley). Interviews generally lasted from 20 to 60 minutes and were conducted in professionals' offices, at community meetings or in informants' homes. All interviews were digitally recorded and later transcribed.

Data Analysis

The interviews resulted in a large data set, so the senior author conducted a thematic analysis of the data using the Atlas-ti program for qualitative data. The program allowed us to organize and develop codes in order to identify relevant themes that emerged from the interview data (Silverman 2001). In line with the logic of analytic induction, thematic analysis is a means for identifying and expressing patterns in qualitative data; the researcher codes statements into categories reflective of observed patterns in the data. These are then situated into larger themes and illustrated by representative quotations through multiple stages of increasingly restrictive coding (Boyatzis 1998; Aronson 1994).

Results

Nearly all the participants interviewed saw development of alternatives to evacuation such as SIP as a positive endeavor, and believed that one day alternatives would become viable, with risks and benefits at least comparable to evacuation. However, both professionals and residents indicated that further testing and evaluation of alternatives were necessary to convince them that residents would be better off staying in their homes rather than evacuating. As one San Diego county fire professional said:

> I mean Rancho Santa Fe has these shelter-in-place communities but there has not been one fire that has come through to demonstrate that these are effective... But if there were one, you know, that ended up having a holding point or that there was a particular group of homeowners that were prepared to shelter-in-place and they did...and that they demonstrated that their homes are still there...Then I think it could potentially begin to shift that paradigm.

Fire Professionals

The RSF District staff feels that their SIP policy is a "moderate approach" to the question of alternatives to evacuation. Most district officials stated that they did not encourage residents to shelter as a primary strategy, but described SIP as "another tool in the toolbox for firefighters" that could be employed in certain situations. Fire professionals in the RSF District held a variety of opinions on what the concept of shelter-in-place means. On one hand, the RSF District literature disseminated to residents is very clear about what their SIP policy means:

> By residing in one of the five communities listed below, your home is considered shelter-in-place. **This means that you will *not* evacuate during a wildfire.** Homes in these master-planned communities are designed and constructed to withstand wildfire, so residents are safe to shelter inside. [Bold and italics included in the District literature] (Rancho Santa Fe Fire Protection District 2004)[1]

Despite this statement, the majority of RSF District officials we talked to acknowledged that they consider evacuation the safest alternative. As one District fire official said:

> Well let's do shelter-in-place. And everybody has a different concept...I don't recommend that [residents] stay like they do in Australia and fight the fire...I fall on get out early, because most people don't know what to expect in wildland fire.

It also became clear during our interviews and review of the RSF Districts codes that some fire professionals believe that SIP policy is about home construction and actions to increase preparedness—actions taken *before* the fire event:

> … [other officials and residents] think [the policy is] stay and defend. They are really stuck on that. We are saying no, it's not, its dealing with proper building construction and other issues.

[1] Versions of the RSF District literature produced after this study clarify the incongruence in this message. The title of the most recent outreach material states: "Shelter-In-Place...If You Can't Evacuate." The publication identifies early evacuation as the best option, describes SIP as a choice and advocates SIP when residents are trapped by fire (RSF 2009*a*).

The above RSF District official has interpreted the policy as an effort to reduce wildfire hazards in and around homes (what Cohen (2000) calls the "home-ignition zone") and not necessarily an approach that would allow residents to remain in their homes during fires.

San Diego fire professionals outside the RSF District are not any closer to consensus on what it means to have a SIP policy or to be an SIP community. As one CAL FIRE representative said:

> I am not sure there is a consensus [on the use of SIP]… I think any consensus would be just heavily biased on who was doing the talking to who and which fine point, which subtle node of complexity you were dealing with…it's not necessarily a new idea but it's a new, it's relatively new here…so there hasn't been a lot of discussion and all about it.

Evacuation (or relocation, as some preferred) remained the primary protective strategy during fire among managers and professionals in the San Diego area as it did for RSF District professionals: "You know evacuation is always really like what is first encouraged regardless of if it's a fire safe community or shelter-in-place community."

However, professionals in both the RSF District and outside of it recognized that there are instances where evacuation is not practical or safe. As one fire protection consultant and former Incident Commander for the USDA Forest Service summarized:

> At some point in a timeline, it's more dangerous to leave than it is to stay…Up until [a certain time] before, fine, leave. Take your sick grandmother, load your pets and your cats and your dogs and your horses and stuff. Go ahead and leave, I think it's great…but at some point that timeline closes…the evacuation needs to be cut off…So when is that? Well, you gotta have a lot of information, but I think it's better than letting it go till a certain point and then tell them to evacuate. Because then…the die is cast. These people are just going to be victims of their circumstances.

This quote suggests the need to develop principles around alternatives to evacuation, so that when appropriate or necessary, an alternative such as SIP could be used as a primary strategy.

Despite the confusion and lack of consensus, few of the professionals were inflexible on the subject of alternatives to evacuation, and many indicated that new ideas were beginning to be considered. As one former fire marshal said, "now [many professionals] are stepping back and they are willing to take a look at [SIP]. Before they were just adamantly opposed to it." What was clear from the interviews was the need for additional discussion of where SIP and other alternatives fit in the established structures and procedures of local firefighting agencies. As one fire professional with experience in San Diego and state-level fire policy explained:

> Well you can't just make the statement "I will shelter-in-place" without a properly designed community...the term has been misused...it needs to be defined. And probably at some point defined in the code, fire code.

In general, perceptions of SIP as an alternative to evacuation by fire professionals in the Rancho Santa Fe area (including within organizations) ran along a continuum from perceived low utility and applicability to perceived high utility and applicability (Figure 1). These differences in the perceived usefulness of alternatives among professionals no doubt dictate the development and understanding of any policy regarding alternatives, including within the RSF District. Our data indicate that an individual's fire fighting experience affects where they fall on this continuum. People with *both* wildland fire fighting experience and structural fire protection experience were more likely to support alternatives to evacuation than people with only one kind of experience. In addition, those who indicated that they had the freedom to innovate with their organizations were more supportive of alternatives. Of the people we interviewed, consultants in subdivision fire protection planning and development were most likely to perceive SIP as having high utility or applicability. They are the people most likely to have diverse fire fighting experience (due to previous career involvements) and to be independent of highly organized fire fighting organizations.

Fire fighters who expressed concern that their organizations could be held liable if residents or their property were impacted due to new protective measures tended to be less supportive of alternatives. One fire professional summed up this sentiment: "The fire services, because of political and liability issues, they will never say shelter-in-place is first priority..."

In summary, professionals were less likely to see alternatives to evacuation as having high applicability or utility if (1) their fire fighting experiences are primarily in one area (structural or wildland), (2) they work for organizations with strict practices, procedures, and fire fighting protocols, and/or (3) their agency would likely be blamed for any damage or casualty resulting from implementation of the alternative.

Local Residents

Resident Awareness and Perception of SIP—Interview results indicate that resident awareness and understanding of SIP implemented in the RSF District communities were undeveloped. Only some of the residents interviewed were aware of the SIP policy or the planning that had occurred in their respective communities.

More residents were aware of the SIP option in the relatively homogeneous gated communities studied than 4S Ranch, a much larger, open community that resembles a more traditional neighborhood. Residents in the gated communities of The Crosby and Cielo were most aware of the SIP policy. This increased awareness could be explained in The Crosby by newly placed signs advertising "shelter-in-place" and a recent educational presentation by the RSF District. However, many of these residents also became aware of the SIP prescriptions when building or remodeling a home. As one Cielo resident explained:

> I think we learned [about SIP] because, when we were going through our plans for our house, you know, they are pretty strict on what can be built, what can be

> planted on your slopes…and they said that is because this is a non-evacuation area.

Such involvement in the building process is less common in 4S Ranch, where more designs are pre-planned. Residents in Santa Fe Valley, which is older than the other gated communities mentioned, displayed only slightly more awareness of alternatives than those in 4S Ranch.

Among those residents who were actually aware of the concept of SIP, a majority reported that they did not know what they were actually supposed to do during a fire event. While they knew that they were supposed to remain in their homes, they did not know what to do beyond this. As one Cielo resident articulated:

> What we would all like to know, is um, what is the safest thing to do in case there is a fire. And somebody saying well this is shelter-in-place, that doesn't answer the question…I don't know the conditions under which they expect it to take place…

A lack of understanding about SIP coincided with some residents' plans to remain at home and only evacuate when a wildfire got close, putting them in perhaps the most dangerous situation possible. As one resident from 4S Ranch reasoned:

> I'd stay, I'd stick around. When it started hitting these houses over here, that's when I might be a little worried, that might be like all right, it's time to probably leave.

At least some of the confusion and lack of understanding about alternatives to evacuation stems from resident willingness to "depend on the fact that we got professionals designing this." Residents expressed little interest in playing any role in the planning and implementation of alternatives because they thought the decisions should be left to the professionals. According to the interviewees, this trust in professionals was due to the proximity of fire stations to the SIP

communities, the visibility of firefighters in the community and resident confidence in fire officials' abilities. As one resident in The Crosby said:

> Sometimes if you go to these [homeowner association] meetings and people start having these opinions and you're like, are you kidding me? I think its better just to leave it to the experts to figure out what we should be doing…sometimes, you know, I think that would be way too many chefs in the kitchen.

Residents' Perceived Support of SIP—Fewer than half of the residents interviewed indicated they would actually stay in their homes during a fire event. The choice to implement alternatives was linked to residents' knowledge of the protections in place (i.e. home construction and vegetation management), with residents who understood the additional codes and standards much more likely to support SIP. As previously mentioned, support for fire district personnel also played a role. As one Cielo resident explained:

> I guess at the end of the day, it makes sense. If your house is safer than driving out there, you know, getting caught in the road...you can't see and the fire comes in, it makes a lot of sense. We have sprinkler systems in place...and the house is made out of stucco and brick and tile, so it would be difficult to burn down.

However, many residents explained that they would decide whether to stay or leave based on the circumstances of the fire and how long they had to evacuate:

> I mean [I would make my decision to stay or go] according to the odds of whether I would be in trouble or not, I wouldn't want to stay in my house if fire was surrounding it and it was up to me to fight it.

Residents who indicated that they would not SIP during a fire often reacted to alternatives by assuming that they were aimed toward reducing damage *to structures* and that the practice carried with it more *personal* risk than evacuation, an option they viewed as safer. What often followed was something we have dubbed the "insurance motivation," best articulated by this response from a homeowner in 4S Ranch:

> As far as I'm concerned you can burn a place to the ground and I got insurance. As long as I get my hound out of here and my family, everything will be cool.

Residents' Perceptions of Role of Fire Fighting Organizations— Fire fighting professionals and agencies were perceived by the residents we interviewed as most liable for the safety of residents given a SIP recommendation. As one resident said:

> Well I think for the fire department to say stay in your house, they're liable just by making that statement because they are an authority figure...they're supposed to know more than you are, so if you stay in your house...and you die, they should have some liability to that.

The residents in these Rancho Santa Fe communities see themselves as (high-end) suburbanites living adjacent to a metropolitan area rather than as WUI residents living near wild lands. As such, they expect the protections inherent in municipal areas characterized by structural fire fighting practices. As one resident of The Crosby said:

> You would expect when you're in a high-end community, that there'd be rules about the structure of your home as well as compliant things that are expected and so forth and by and large, I mean if there's been any complaint about any things, it's just the fact that people would like to live with no rules in life.

Discussion

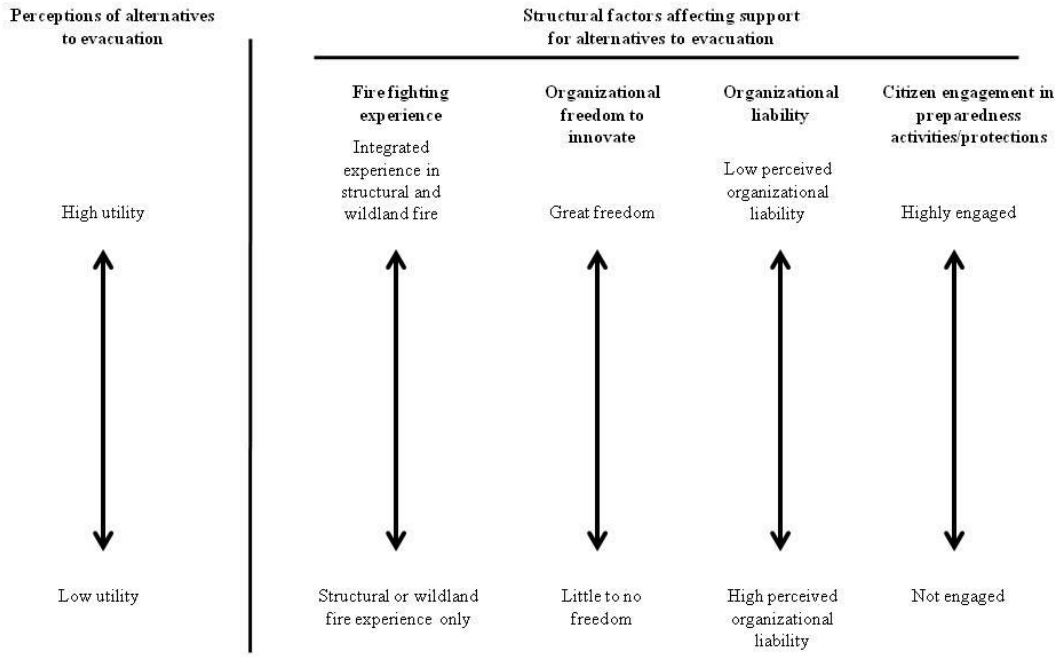
Despite literature and media coverage that have clearly identified housing developments within the Rancho Santa Fe Fire Protection District as SIP communities, there is little consensus on the part of fire professionals or residents on what it means to be a SIP community, nor broad-based support for working to achieve that consensus. We would maintain that in fact, the RSF District has really *not* implemented a SIP policy that encourages residents to stay during a wildland fire. Rather the RSF District has clear and consistent guidelines for building and landscaping that are strictly enforced to minimize damage during wildland fire. In fact, some of the residents and fire managers we interviewed defined SIP as a protective strategy for structures

and property. While the structural and landscaping elements of SIP are in place in our case study communities, the social elements of SIP, including preparing residents for the psychological impacts of such a policy, are missing. Evidence of the effectiveness of the structural and landscaping guidelines was provided by the 197,900 acre Witch Fire that passed directly through the RSF District SIP communities in 2007. Although the fire destroyed more than 2,220 homes, no homes were damaged or destroyed in the RSF District SIP communities. However the five RSF District SIP communities were included in the evacuation order resulting from the fire, and residents left their homes (Ekard et al. 2007).

Firefighting Organizations and the Adoption of Alternatives to Evacuation

Structuration theory helps us understand the factors that facilitated or constrained the adoption of SIP in the RSF District and affect the adoption of alternatives to evacuation elsewhere. Regardless of the RSF District's relative independence, there is a hierarchy of organizations in San Diego County that promote wildland fire preparedness, response and recovery. These include federal, state, and local agencies or governments, not to mention other local entities (for example, Fire Safe Councils). Each organization operates under different rules, plays different roles and deploys a variety of resources in the management of wildfire. These characteristics, which clearly fall under Giddens' (1984) notion of "structure," fall along a continuum that reflects the organization's ability and flexibility to implement innovations such as alternatives to evacuation (Figure 1).

Figure 1: Linking perceptions of alternatives to evacuation with structural factors affecting support for alternatives



Of the San Diego area fire organizations included in this study, the locally based RSF District was most flexible. Because the RSF District focuses on a limited geographic area with fairly homogeneous ecological and social contexts, it can tailor programs aimed at reducing fire risk, including alternatives to evacuation, to the needs of the community, and can work with community residents to help them understand the implications of any initiative. In addition, if implementation of an alternative to evacuation involved reorganizing the RSF District or writing new guidelines and procedures, these steps would be easier to take in an organization the size of the District rather than in a larger and more diverse organization. The RSF District was able to adopt *its version* of shelter-in-place with the support and guidance of a few local champions who had the trust of local residents. This support and that of professionals in the RSF District allowed them to adopt stricter codes and practices than the surrounding areas.

Larger and perhaps less flexible organizations like CAL FIRE and the San Diego County government develop initiatives for a diverse set of communities and landscapes, and therefore cannot address many of the specific local concerns of any one community. Furthermore, new or revised codes and standards may need to go through a much longer process of adoption involving other departments or agencies at higher and lower scales. In short, the rigidity of their current practices and codes are much more difficult to change. Given the aforementioned issues, the size of these agencies and their diverse structures, it's understandable that adoption of alternatives to evacuation would be slower and more problematic. These results support discussions of structural constraints by Paveglio et al. (2008) and McCaffrey and Rhodes (2009).

One advantage a broad-scale organization such as CAL FIRE or a San Diego County department has over a local fire protection district is that once a decision is made, it is possible to work across jurisdictions to achieve multi-organization collaboration on the new initiative. Working across jurisdictions is much more difficult for a local entity like the RSF District. Thus, while CAL FIRE or San Diego County may have more capacity and resources to put new initiatives into action, implementation of alternatives at a local scale can be constrained because of the variation in capacity (including social norms and values) across their jurisdictions.

Residents and fire professionals in the RSF District identified another factor in the adoption of alternatives to evacuation—liability. As evidenced in our results, traditional firefighting professionals and organizations are perceived as having higher levels of liability than others involved in fire management (consultants, outreach specialists, NGOs) should application of currently non-standard procedures such as alternatives to evacuation result in damage to or loss of property and life. Overcoming this challenge will not be an easy task given the litigious

culture of America and many residents' expectations regarding the services that should be provided by local or county governments (Daniel 2007).

Professional support for alternatives to evacuation reflects differences in firefighting training and experience. Given the enduring nature of these experiences and the tradition of fire organizations (Pyne 2001), expecting every professional to approach the topic of alternatives to evacuation uniformly is naïve at best. However, we observed that an ability to integrate wildland and structural firefighting experience enables professionals to support and begin to implement alternatives to evacuation, while having experience in only one setting (structural or wildland firefighting experience but not both) constrains wildfire managers in adoption of alternatives.

Finally, the structures of fire management organizations place central focus on the safety of both professionals and local residents, and the consideration of alternatives to evacuation is an attempt to increase their safety. However, fire management is also about understanding the role of fire in the natural landscape. A move to reintroduce fire in and around expanding wildland-urban interface communities blurs the lines between suppression and management (Steelman and Burke 2007) and challenges the old notions and boundaries that are the foundation of U.S. fire organizations and the standards of safety the public has come to expect. This means that managers considering alternatives to evacuation cannot simply approach the problem from a firefighting perspective. Rather, alternatives to evacuation make fire managers and local residents partners in fire preparedness, suppression and recovery, and in finding ways to live with fire as an inevitable part of the landscape (Jakes et al. 2007*a*, Jakes et al. 2007*b*). This will require a larger, community-wide interplay between fire professionals and local residents as they work to find solutions that all can live with and implement effectively.

Using structuration theory, the result of these differences in organizational structure, professional socialization and firefighting experience can help explain the variance in professional conception and perceived utility for alternatives to evacuation (even within organizations). According to Giddens (1984), individual actors use their personal experience to reflexively monitor communication about a particular issue and decide upon its meaning. Practice becomes structure when the meaning for an object (in this case SIP) is agreed upon among actors. This shared meaning becomes the basis for action. Given the different experiences, training and organizational structure that define professionals' experience and communication with others, it is of little surprise that they often conceive of SIP or related concepts differently.

Local Residents and the Adoption of Alternatives to Evacuation

Regarding local residents and the adoption of alternatives to evacuation (in this case SIP), Giddens (1984, 1991) and Edwards (2000) have pointed out that enabling populations to adopt new innovations means sufficiently modifying or overcoming the structural constraints limiting their ability to do so. This may be especially challenging for alternatives to evacuation given our longstanding conceptions of fire as a destructive, alien event which humans need to suppress and flee from (Pyne 2001). Adoption of alternatives to evacuation is also constrained because residents do not perceive the alternatives as legitimate and viable as protective measures for themselves and their property. In our research, residents and some managers expressed a desire for additional evidence (structure) and assurance that staying in properly designed homes or neighborhoods is indeed safer than evacuation. Although we identified some of the most notable physical fire research related to evacuation (Cova 2005), building materials and the ignitability

of structures (Cohen 2000), none of this research deals explicitly with the prospect of residents remaining in structures during the fire. Faced with inconsistent structure, residents and managers will generally not adopt a new initiative such as alternatives to evacuation. This is due to a lack of assurance that their choice will result in additional protection or avoid harm. Giddens (1984) called this "ontological security," a crucial component in societal participation.

From a practical perspective, our research indicates that the most significant and currently unaddressed factor constraining the development, modification or enactment of alternatives to evacuation by local residents and property owners is an understanding of what alternatives like SIP mean for residents during a fire. In addition, the lack of standardization and the conflicting views of fire professionals in the San Diego area about alternatives contribute to confusion among local residents about SIP. This finding reflects similar results in an Australian study of SDLE by Tibbits and Whittaker (2007). In the RSF District we saw that those residents who were most informed and involved in the preparedness process were most supportive of alternatives to evacuation (Figure 1). This engagement often occurs when building guidelines are enforced and people seek explanation as to why they are being required to take certain steps. But local residents have received no training as to what to do when a fire approaches. In addition to knowing what action to take in defending a home during a wildfire, there needs to be dialogue around associated psychological impacts of staying.

In the terminology of structuration theory, there has been little to no structure developed within organizations or within the community around alternatives to evacuation—no codified sense of what it means, no enabling of local actors to adopt and replicate the new ideas surrounding alternatives. Thus, key actors revert to replicating the established structure

surrounding traditional wildland fire responses (i.e. evacuation) because fire fighters and residents are familiar with this response and understand why that action is taken.

Conclusions

Consideration and implementation of alternatives to evacuation will continue to grow in the U.S. as residents, fire managers and local government representatives seek ways to better protect WUI communities. Places like The Rancho Santa Fe Fire District have earned a great deal of respect for the advances they have made concerning the physical standards necessary to advance these protections. However, the diverse social and ecological contexts found in WUI communities will require different approaches to developing and implementing alternatives to evacuation (Paveglio et al. 2009, Paveglio et al. 2008). For example, the physical standards (primarily building codes and landscaping requirements) in place at Rancho Santa Fe could be more difficult to implement and enforce in less affluent communities. Yet financial capacity need not be a barrier to implementation when elements of community capacity such as social norms and reciprocity support a community's adoption of alternatives (Jakes et al. 2007*b*). Conversely, these elements may discourage a community from adopting alternatives despite adequate financial capacity; for example, local residents may not support regulations affecting private property development necessary to insure the reduction of hazards in the home ignition zone. More rural but less affluent residents may be more engaged in the planning necessary to implement alternatives to evacuation due stronger local ties and experiences with other collaborative projects that facilitate collective solutions. Local culture and experiences gained from living in fire-adapted ecological systems have also resulted in rural residents having greater understanding and increased ability to reduce some aspects of risk (i.e. personal vegetation

management, previous fire experience) (Paveglio et al. 2009). Planning that originates with residents or includes them as major participants may well be most effective in developing alternatives for protecting local populations (Jakes et al. 2007*b*). Finally, the biophysical conditions of local ecosystems (i.e. fuel types and loadings, aspect, exposure) will dictate whether and what type of alternatives may be possible across a landscape. Our research suggests that a unifying definition or standardization of alternatives across a broad political landscape may be sought by some professionals, but will not guarantee success. Rather these are fundamentally local decisions and it is at the local level (a neighborhood, community, or county) that agreement will be most critical (Carroll et al. 2006).

Overcoming a reflexive response of evacuation during every major WUI fire means recognizing the importance of increased understanding for alternatives to evacuation among the *local* organizations disseminating information or enforcing codes *and* among residents expected to play a role. The development of definitions and guiding principles for alternatives to evacuation at the national level by leading professionals and political leaders may be important to some, yet ultimately each locality will need to interpret alternatives to evacuation within the local context. This is clearly the case with the Rancho Santa Fe Fire District, which has advanced its version of alternatives beyond that of surrounding areas and overlapping organizations' jurisdictions. Where the RSF District plan needs further development is first in building uniform understanding of their alternatives among local organizations and individuals within the community, and then across the broader social landscape.

It is not necessary that everyone agree on a checklist for employing alternatives, rather the stakeholders involved should agree on their *viability in dynamic situations*. For example, is the alternative a primary response, a secondary consideration, or a last ditch effort when

evacuation is not possible? How does implementation of alternatives change given a variety of fire environments during the event, the estimated time for evacuation of affected publics, or the percentage of people indicating they would remain at home in a fire event? Such adaptive mechanisms create the structure needed for professionals and residents to implement the alternatives but do not overtly constrain action to the point where professionals are not allowed to make on-the-ground or site-specific decisions should conditions change.

Such measures can also help overcome issues of liability by explicitly setting forth policies and procedures implicating alternatives as a *choice* that do not guarantee either life safety or reduced property damage. These efforts can begin to provide a paper trail and legal precedent that could start to alleviate resident conception that fire authorities should always bear legal liability, especially in providing information about a personal decision like the implementation of alternatives to evacuation. It is unlikely that such strategies will immediately change the legal landscape of fire protections. However, it provides some initial progress concerning an issue that is central to future fire protections and will undoubtedly need further discussion.

This case study identifies some preliminary social factors for fire professionals and other managers to consider in the development of alternatives to evacuation. These considerations are crucial steps which compliment the development of physical standards for protection. This research broadly addresses some of the many complex and detailed issues that still need to be explored surrounding the applicability of alternatives to evacuation during fire. For instance, social issues including communication and outreach need to be more thoroughly addressed, as do the impacts of different community cultures and local knowledge. Other issues we were not able to address but nonetheless are crucial research include the roles of other stakeholder groups such

as homeowners associations, Fire Safe Councils, outreach organizations (i.e. Firewise), developers and insurance companies. Additional work on all these subjects will give us a better picture of what role alternatives will continue to play in the protection of a resident population at risk in an age of fire inclusion and increased risk.

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CHAPTER 5:

UNDERSTANDING SOCIAL COMPLEXITY IN THE WILDLAND URBAN INTERFACE: A NEW SPECIES OF HUMAN HABITATION

The wildland urban interface (WUI) is the area where residential development is juxtaposed proximate to wildland areas (USDA 2001; USDA and USDI 1995). Current estimates indicate the WUI covers more than 9 percent of land mass across the contiguous United States (Stewart and others 2007) and it is widely regarded as a focal point for human-environmental conflicts and policy conundrums ranging from habitat fragmentation to wildland fire protection. In this paper we focus on the issue of fire hazard in the WUI to more meaningfully characterize the social complexity in this evolving area of human habitation. By analyzing the literature and data from case study research on community wildfire protection planning, we hope to advance the discussion of what that complexity means for natural resource management, policy, and most especially, successful adaptation by residents faced with increasing risks inherent to living in the WUI.

According to the National Interagency Fire Center (2008), more than 85,800 fires burned more than 9 million acres in 2007, part of a growing prevalence since 2000. An estimated 5,326 structures were destroyed by fire in 2007, excluding seasonal homes for which data was not collected (NIFC 2008). The U.S. Government Accountability Office (2007) reported that cost for federal agencies to prepare and respond to wildfires rose from $1.1 billion per year between 1996 through 2000 to more than $2.9 million per year in between 2001 to 2005, while the majority of fire suppression costs by the U.S. Forest Service are attributed to the protection of homes in the WUI (Office of Inspector General 2006). Theses numbers indicate an increasing impact of

wildfires on WUI communities and highlight the need for additional consideration of community capacity to deal with such disturbances.

The continuing progression of spatial studies concerning evacuation capacity, fuel modeling and development trends of communities in the WUI have been key in preventive management of wildland fire (Stewart and others 2007; Radeloff and others 2005; Zhang and Wimberly 2007). Yet researchers and policy makers have paid less attention to the mapping of another important variable in WUI management: the diversity and variability of people and communities occupying the area in question. Missing is an explicit recognition that the WUI may well constitute a "new species" of human habitation that begs better understanding on a conceptual level.

Scholars have tended to treat the WUI as the simple extension of urban settlement or the further development of traditional rural areas, yet these characterizations have not captured all that the WUI is; nor do the past distinctions of rural versus urban or extraction-, amenity-, or tourism based settlements tell the whole story. The WUI is *all* of these and other social, political and economic characteristics interacting in close proximity, often resulting in a complex mosaic of social adaptation and local culture spread across the country. Resulting interactions are both the source and result of changing patterns of social functioning across the landscape. Understanding the differences in the social context of WUI communities, including place-based experience, demographic/structural characteristics, access to scientific/technical information, and the informal interactions/relationships residents have with one another is critical to knowing (1) how new policies and regulations may affect local action to achieve national goals and (2) how communities can successfully adapt to virtually any resource issue, including fire management. A number of studies have shown that some communities have greater capacities for the mobilization of collective resources before, during and after disturbance events (Luloff and

Swanson 1995; Flint and Luloff 2007). These studies focused at the community level link to the very large and robust literatures on risk, risk perception and response to human disasters (Slovic 1993; Quarentelli and Dynes 1976; Drabek, 1986). Likewise, there are a number of social science concepts linked to the ability of a community to adapt to various economic, social and demographic changes, including community capacity, community resiliency, and community viability (Donahue and Haynes 2002; Haynes 2003). While there is much debate concerning the overlap of these terms, most scholars and managers would agree that a community's capacity to adapt is a multifaceted concept which can change given the specific disturbance events (i.e. fire). Wall and Marzall (2006) define adaptive capacity as a "set of characteristics that allows a given system to perceive change or threatening circumstances, evaluate them, decide on a solution path and both develop and adopt processes and tools to manage the risk, thereby maintaining itself throughout (Wall and Marzall 2006, p. 378)."

This research helps extend work on these various aspects of community capacity to adapt (Donahue and Sturtevant 2007) by beginning to explore what specific attributes of communities are needed for adaptation to the risk of wildland fire. Such a synthesis is needed to help reconcile and refine the growing body of literature on social/community capacity to deal with different aspects of wildfire preparedness, mitigation and recovery (Cohn and others 2008; Walker and others 2006).

One element of social context related to adaptive capacity that is often overlooked is the knowledge component. This knowledge component includes (1) access to scientific/technical information concerning disturbance and (2) resident knowledge of the local ecosystem and/or culture (hereafter referred to as local knowledge). Along with the demographic/structural characteristics of a community and the interactions/relationships between its residents, these

components of social adaptability are an often overlooked component of hazard resiliency (Wilkinson 1991). Resilience is defined as the capacity of a system to absorb disturbance and reorganize during change to retain essentially the same function, structure, and identity (Berkes 2007). While resilience often focuses on returning a community to some original state following a disturbance, adaptation focuses on moving a community on to something new. Both adaptive capacity and resilience point to the importance of social and structural components in addressing change, including the evolution of social systems in relation to a bio-physical environment and the way historical and current social systems are linked to hazards threatening the community.

In response to the above issues, we wish to advance a conceptual understanding of the differing levels and elements of social context in the WUI. This includes the various elements of adaptation needed to solve problems in WUI areas and increase resiliency of communities within its borders. The idea here is to (1) better understand the diversity of people and communities that encompass the WUI and (2) suggest a conceptual framework that will help inform and explain the relationships among elements composing community social context. We believe this understanding will assist managers, policymakers and local residents in adapting to a variety of circumstances surrounding natural resource management.

To accomplish these goals we have organized the remainder of this paper as follows. First, we review and propose the selective use of various theoretical perspectives relating to humans' interactions with their environment to help sort through both the social complexity of the WUI and the myriad issues revolving around the so called "human dimensions" of land/resource management that manifest within its boundaries. Next we illustrate the diverse elements of social context that have influenced the community wildfire protection process in two California communities. The paper concludes with a discussion of how these case studies support our use

of the above theories and what this new theoretical understanding of WUI communities' adaptive capacity means for preparation and mitigation of hazards such as wildland fire.

Literature Review

Existing WUI Literature

Case study research focused on WUI populations has been growing (Walker and others 2006; Bright and Burtz 2006), however the primary thrust of this research seldom explicitly recognizes that very different types of communities and residents exist within its borders. Likewise, the aforementioned mapping studies often submit various physical definitions of the WUI without providing societal context of their attempts. Certain managers, scholars and policy makers have long recognized the importance of differing levels of social adaptability within the WUI. Lee (1991) warned against a common myth that all interface communities are a cohesive unit with residents who know each other, work together or communicate. He warned managers to be prepared for a variety of community approaches and to understand that "every interface conflict stems from competing human attachments to the land." Likewise, Cortner (1991) suggested that, "The commonly used term 'interface' may not define the changing relationships between people and wildlands." Jakes and others (1998a, b) extended this line of argument by calling for different management approaches based on "functional communities," defined as geographical areas where residents share perceptions and relationships with the surrounding natural resources. These studies demonstrate the existing links between space, community and culture we hope to build on in our development of a conceptual understanding for the WUI.

More recently, a number of studies about fire in the WUI demonstrate variability in knowledge levels, demographics and the nature of social networks among residents of disparate

communities. For instance Brunson and Shindler (2004) and Nelson and others (2005) have demonstrated variability in resident knowledge or acceptance of fire mitigation strategies based on local environmental and social characteristics while Carroll and others (2004) found differences in forest landholders' perception of fire (both wildland and prescribed) as a threat or a tool and willingness to take measures in response based on past experience with fire, land tenure, financial and physical restraints. Others have shown that WUI residents vary in their willingness to pay for fuel treatments or maintain defensible space based on their status as full-time residents or seasonal users (Walker and others 2006; Bright and Burtz 2006) or how differing socioeconomic variables such as poverty may affect the average size or destructiveness of locally experienced fires (Mercer and Prestemon 2005).

Case study research has also shown how the social context of WUI communities affects wildfire preparedness. Jakes and others (2007b) have shown that landscape, government involvement, human capacity, and social capacity were important to the success of wildland fire preparedness initiatives in 15 U.S. communities. Different levels of these elements help explain why some WUI communities are more successful than others in taking responsibility for reducing wildfire risk. In Australia, agency involvement, human capacity and social capacity were also found to be important to successful community wildfire preparedness (McGee and Russell 2003).

Steelman and Kunkel (2004) describe the importance of structural and social responses to wildfire threats. Social responses refer to actions that improve decision making, organization, management and planning that help communities assess, support and chose among different approaches to wildfire management. The social context of a community determines its ability to

initiate social responses to wildfire, and the variability of social contexts will result in differences in the effectiveness of different social responses.

Even spatial studies of the WUI hint at varying levels of vulnerability to hazards and community adaptability within its parameters. The definition of WUI communities in the Federal Register (USDA 2001), and the basis for recent GIS efforts mapping the extent of the WUI (Stewart and others 2007; Haight, and others 2004), differentiate between the wildland urban intermix and wildland urban interface based on levels of development and density of nearby wildland vegetation. Meanwhile Zhang and Wimberly (2007) point out the importance of using spatial data at different levels of aggregation (county, census tract, etc.) to demonstrate how it can affect the distinction of the WUI. The USDA Southern Wildland-Urban Interface Assessment (2002) separates the WUI into four geographical categories: A "classic" WUI of urban sprawl; a wildland urban intermix characterized by a shift to agriculture and urban fringe; the isolated WUI composed of remote residences; and WUI islands within urban areas. All of these designations include inherent social, economic or democratic influence by communities on the area in question, yet there is little attempt to integrate this into management or policy. Mapping studies such as Stewart and others (2007) and Radeloff and others (2005) are a very important first step in dealing with human presence by incorporating housing density. Yet they leave it for others to address the complexities of how different types of social arrangements and their interaction with the natural environment may have on the mapped areas in question.

What is needed to compliment recent advances in the biophysical understanding of the WUI is the component social theory that extends thinking by Lee, Cortner, and Jakes described above. While recent studies highlight the interaction between demographic variables and fire-related issues of protection (Walker and others 2006; Bright and Burtz 2006), they are not informed by a

larger and more abstract understanding of their interaction with other social or biophysical characteristics. Such linkages can explain why and how collective adaptive behavior relative to fire conditions does or does not happen in particular locales in the WUI.

For this purpose we draw mainly from two areas of sociological inquiry to create a framework for better understanding WUI diversity: (1) Kenneth Wilkinson's interactional approach to community; (2) and certain aspects of the rapidly developing place literature in natural resource social science.

Sociological Inquiry and the WUI

Interactional Approach to Community. Wilkinson's (1991) interactional approach to community is central to our argument because it recognizes the importance of social interaction in the creation and functioning of locally based social arrangements to solve common problems. This notion extends Toennies (1957) classic views of community volition—natural (Geminschaft) and rational (Gesellschaft)—by portraying the community not as unchanging structure, but rather as a constantly evolving *process* that members from diverse segments of the community are engaged in to meet their needs. Wilkinson (1991) conceives of community as an interactional field because this construction demonstrates how the interactions people have locally create a sense of belonging; it acknowledges the interrelated structure that undergirds a need for social contact and action at local levels to solve problems. As Wilkinson states "So long as people interact, the community in this sense will persist and give rise to collective identity *and action* in the locality (p. 38; emphasis added)."

Wilkinson (1991) also emphasizes the importance of the local surroundings in the development of community: "the interactional conception of the community supports the view that contacts among people define the local territory; and it argues...that characteristics of local settlements are important indicators of social interaction (p.24)." These notions imply an important variable of the local surroundings and lead us to engage aspects of place literature.

Recent work by Flint and others (2008) extends Wilkinson's (1991) notions of interactional field to a regional scale. They contend that geographical development patterns such as urban sprawl have not negated the importance of community in its process sense, but merely created a greater number and complexity of interactions occurring across larger geographical scales. We suggest this re-conceptualization of interactional field theory fits the WUI phenomenon very well as many of the problems needing solutions in the WUI (such as mutual fire aid for example) occur at larger scales than the traditional community or even county but are certainly smaller than that of the state.

Place. Places encompass the physical locality of an area and all that occurs there, including the cultural contexts, meanings, values and experiences of the people who define it (Williams and Stewart 1998; Patterson and Williams, 2005; Brandenburg and Carroll 1995). Here our focus is on local, place-based action as it is informed by both scientific/technical knowledge and (very importantly) by intimate knowledge of local environments.

Particularly important to our exploration of the WUI is Kemmis' (1990) linkage between the social relationships of place and the political or organizational capacities of a given local area. He argues that productive local adaptation takes place primarily when people have emotional as well as practical ties to the physical space they occupy. Taking Wilkinson and Kemmis together,

it can be argued that capacity for dealing successfully with emerging problems is moderated by the relationships people have with their locality and to each other. Specifically, Kemmis argues that "one size does not fit all" and that the solutions to local problems with the most probability of success are those modified to fit local conditions by those people whose lives will be directly affected by them. He argues that cookie cutter solutions imposed by more distant entities tend to engender resistance (or even worse) passivity by local stakeholders. This is not to minimize the need for scientific/technical knowledge or community interaction with experts in such areas as fuels management, fire behavior and the like. Rather we argue that such knowledge needs to be accessible to local actors and adapted to meet local circumstances. This can often be accomplished through the building of relationships among local and non-local actors across geographic and jurisdictional scales (Daniels and Walker 2001)

We feel place-based thinking is important in our expansion of the WUI concept because it suggests that even in areas with seemingly uniform physical characteristics and apparent management needs, workable solutions may well be very different based on the values and knowledge local residents hold individually and collectively for particular settings. We also recognize that place-based knowledge is not uniform or even present in all localities and among all residents (Jakes and others 2007b). Recent work on differences between seasonal residents and full time 'locals" is just one example of the many influences that create differences in the ways homeowners and communities value various aspects of the landscape (thinned forests for example) or attribute different levels of its importance to community functioning (Walker and others 2006; Bright and Burtz 2006). Among others factors influencing place-based knowledge are generational ties to the area (Brandenburg and Carroll 1995) and the specific experiences

local people have had with disturbance events such as fire (Cohn and others 2008) yet one commonality remains clear—these characteristics vary across landscapes and communities.

WUI as a Mosaic. We are certainly not the first to indicate there is a diversity of community types across the United States. However, we count ourselves as part of a growing group of scholars and managers recognizing that this differentiation is not uniform across the landscape, nor is it determined only by quantifiable, demographic characteristics.

For instance, Bell's (1992) description of urban/rural differences attempts to identify and characterize the culture or functioning of communities based on economic, social and demographic characteristics. Bell's work is important to our characterization because it acknowledges the importance of local knowledge and culture in the everyday adaptability of communities studied and the fact that rural and urban people can in some cases bring different kinds of knowledge and perspectives to local problem solving.

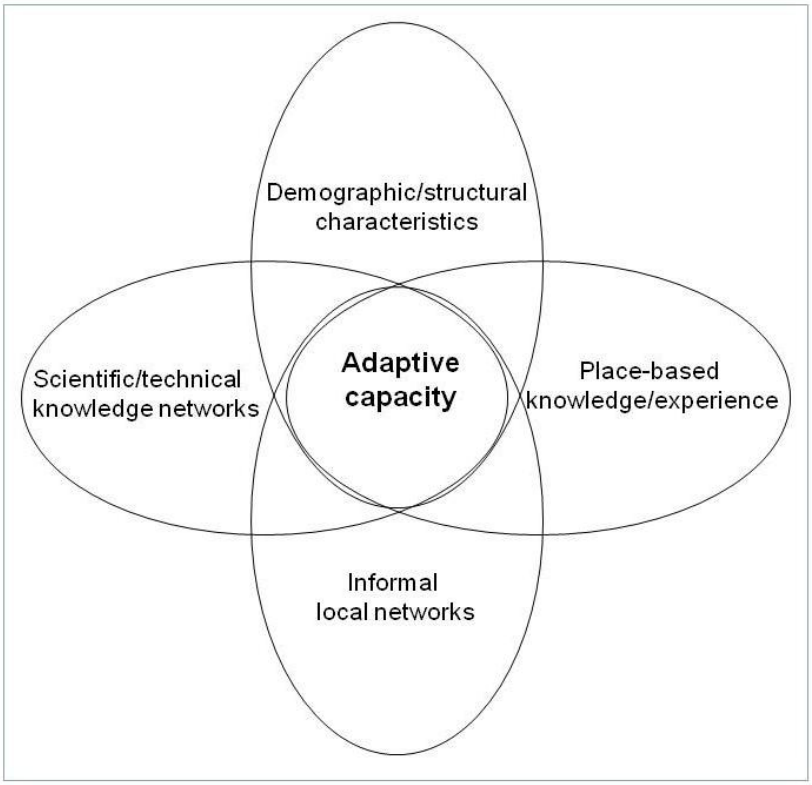
Perhaps the most useful blending of these two perspectives for the WUI is the designation of "New West" and "Old West" communities (Shumway and Otterstrom 2001) partially resulting from the migration of urban populations to undeveloped areas in the American West. This migration of residents causes shifts of economy from traditional extractive industries (ranching and farming) to recreation and tourism. Subsequent changes in population have a drastic effect on the culture and social functioning of the community, including its views of natural resource issues and willingness/ability to collaborate on resource issues (Krannich and Luloff 1991). Particularly important to our discussion of the social characteristics in the WUI is a recent article by Winkler and others (2007) in which they use factor and spatial data analysis to analyze demographic characteristics of "New West" communities in the Intermountain West. The result

was a highly correlated group of characteristics, including socioeconomic class, industry employment or level of education, and the arrangement of "New West" community clusters. Included in their analysis is a continuum of "New West" and "Old West" communities based upon demographic characteristics and the resulting local cultures existing in those localities.

The image emerging from the juxtaposition of these conceptual pieces is neither the WUI as an undifferentiated and monolithic entity, nor simply a collection of neatly bounded communities, but rather a mosaic of complex settlement patterns with overlapping resource problems and capacities for adaptation distributed across the landscape. Natural resource-related problems occurring in these settlement patterns must be dealt with at different scales, including the neighborhood, the geographically bounded community and the region (Flint and others 2008).

WUI populations draw their differences from both quantitative demographic elements and less tangible qualities related to social context (informal knowledge networks, place-based experience/knowledge, scientific/technical knowledge networks) that are much harder to grasp. The varying presence and pervasiveness of these characteristics in different communities dictates the collective ability of its people to adapt and prepare for hazard situations such as fire. We map this relationship in Figure 1. Differences in these adaptive capacities do not stem uniformly from outdated notions of rural and urban, but exist in patchworks of local arrangement dictated at smaller scales that often assumed (Lobao 2004).

Figure 1: Conceptual elements of WUI community adaptive capacity



We cannot be certain of all the specific characteristics that differentiate the social context of different communities and regions; rather, we are beginning the empirical investigation of these characteristics guided by the concepts noted above. The goal is to identify the domains of problem solving needed in the WUI and ways to understand/characterize local/regional abilities to solve them. To that end we will discuss the characteristics of social context which led to the successful development of Community Wildfire Protection Plans in two drastically different WUI communities in California. Comparison of the existing abilities in these communities and the measures needed to improve wildfire protections provide evidence for our claims of differing adaptive capacities of WUI communities across the country.

A Study of Community Wildfire Protection Planning—
Diverse Social Contexts in Two California WUI Communities

In 2003 Congress passed and the president signed the Healthy Forest Restoration Act. The act advocated the development of community wildfire protection plans (CWPP) as a way in which communities could "clarify and refine [their] priorities for the protection of life, property, and critical infrastructure in the wildland-urban interface" (Society of American Foresters 2004, p.2). Over the past 4 years, CWPPs have become "one of the most successful tools" for communities to develop collaborative strategies to reduce wildfire risk in the WUI (CWPP Task Force 2008, p.2).

The Joint Fire Science Program funded a project to investigate how CWPPs enhance collaboration between communities and fire management agencies, and how the development of CWPPs builds community capacity (Jakes and others 2007a). Case studies were conducted in 13 communities in eight states. Using data from the two California case study communities, we can illustrate how the social contexts of WUI communities vary across the landscape and how these contexts influenced the development of CWPPs.

Auburn Lake Trails (ALT) and Grizzly Flat are regulated by the same state (California) and county (El Dorado County) governments. Both were identified as high fire risk communities by the El Dorado County Fire Safe Council, and the California Department of Forestry and Fire Protection (CDF at the time, now called CAL FIRE), and received funding to hire consultants to develop CWPPs in both communities. Although sharing these similarities, the two communities vary in terms of social interaction, a sense of belonging, and other elements of social context.

Auburn Lake Trails

ALT is an unincorporated gated community of more than 950 homes located on the southern rim of a deep canyon formed by the Middle Fork of the American River near the city of Auburn. As the name implies, Auburn Lake Trails was envisioned as a lakeshore community, but the dam on the American River has never been built and current residents focus their leisure activities on horseback riding and golf. Annual grasses, chaparral, oak and mixed conifers present a mosaic of highly flammable vegetation.

The Auburn Lake Trails Property Owners Association's Board of Directors is responsible for adopting, establishing and seeing to the enforcement of rules and regulations governing the community, and for levying and collecting assessments to cover management costs. One local resident observed:

> [The ALT Board has] an organization that is equal, I think, to almost any large or small city.

ALT is a community rich is community capital. This is a community that has significant human capacity. The local population, particularly the retirees, has the experience and education to move the community forward in various areas of interest. They also know how to work the different governmental systems to overcome barriers to action. An ALT employee who does not live in the community said,

> [the local residents] are pretty much prone to be well educated in college. They are socially aware, they're aware of their responsibilities.

Activities to reduce hazards in the home ignition zone are centered in the Volunteers in Prevention (VIP) program. VIP is a California Department of Forestry (CDF) fire prevention and loss reduction education program. The CDF and local fire department initiated the ALT VIPs in

1989. ALT residents were frustrated by the CDF's limited budget for program implementation, and feeling that more could be done, took over the program in 2003. The core of the ALT VIP program is the annual inspection of each ALT property by local volunteers. Property owners are informed of work that needs to be done to reduce fuels on their property and to reduce structural ignitability, and the property is re-inspected to make sure work is done. Owners can be fined if recommended actions have not been carried out. As the community manager observed:

> I think the fact that you have the VIPs, we had fifty people who every year would dedicate a day or so out of their hot summers to go out and do inspections. And we really try to use them as a backbone for a lot of this vegetation stuff.

ALT has been recognized by the Firewise Communities USA program. This program provides local residents knowledge to improve and maintain wildfire preparedness, while ensuring the safety and efficiency of activities necessary during a wildland fire emergency. As stated on the program's website: "The program draws on a community's spirit, its resolve, and its willingness to take responsibility for its ignition potential." The focus of the VIP and Firewise Communities USA programs has led residents to frame the wildfire issue primarily as a fuels reduction problem.

The CDF and Bureau of Reclamation, which manages the public lands along the American River Canyon, have been creating a shaded fuel break along the northern boundary of ALT. Although the fuel break will not stop a fire from moving into the community, it provides defensible space that will make it easier for fire fighters to protect homes. This project is seen as part of a multi-stakeholder cooperative effort to reduce the fire risk in ALT:

> We have the CDF, and they're responsible for treatment along the perimeter shaded fuel break, especially on federal lands. We have the Association, which is joint[ly] responsible with the CDF on some of that shaded fuel break and some of the common parcels we have. And we have the homeowners who own the lots and are responsible as well.

Although the El Dorado County Fire Safe Council had developed a county CWPP that served, according to one emergency manager, as a "kind of an umbrella CWPP that all the more specific individual communities would be nested underneath," ALT residents did not see their CWPP as falling under the county plan;

> We don't agree with the way in which [the County CWPP] focus[es] on certain things, we don't agree with the way which the CWPP was formed, we feel like it's a waste of time and money; but we're here with what we have here.

The ALT CWPP was developed by contractors who were trusted as professionals that could get the job done. Although the contractors kept the Board and interested homeowners informed of their progress, it was not a particularly collaborative effort. The Board and local residents were comfortable with this process. When researchers asked local property owners if they ever questioned the contractors on the projects and priorities contained in the CWPP, they replied, "How did we know how to question them?" and "It's a Bible we accept."

The ALT bylaws, outlining the local government structure and procesess, provide ALT the means to codify requirements related to fuels management, and to assess property owners for work necessary to reduce risk of wildfire. This financial capital provides the funding for staff to conduct home assessment follow-ups and perform fuels reduction work on common property and along transportation corridors. Association funds are also used as matching funds for grants.

The Board created the Resources Management Department, and the Department has adopted the projects identified in the CWPP as part of their 5-year work plan. A Board member described the CWPP as the Department's "blueprint" for action. Property owner assessments have been raised to help cover the costs of the fuels reduction projects. This increase in dues was presented at an annual property owners' meeting, along with some additional increases for other projects. One local resident described what happened at that meeting when property owners began to complain about the increases:

> [The Board president asked] 'Do you want to eliminate the fuel reduction project?' Not a single soul [did]. They attacked all the other projects, but not the fuels reduction.

The ALT culture has developed with some sense that the wildfire problem is a community problem. One member of the ALT Board commented,

> They believe they [can do something about the wildfire problem], and they know that it's not going to stop [the fire], but it's going to be a big help.

Local residents feel that this local knowledge, community organization and property owner commitment to fuels reduction reflects well on their funding proposals:

> I think that's one of the things that people who are granting us funds are looking at too. They're saying, '[ALT is] an organization… that they're going to sustain themselves, and they're going to set aside funds to do this every year, and they're going to try to raise funds… and it goes on and on and on.

ALT staff claim that the community has bought into the goal of fuels reduction and the mechanism to be used to accomplish various projects. They stress the importance of peer pressure and the concept of being a member of the community in achieving these goals:

> You drive through [ALT and] you'll see more and more being done, the community is building with enthusiasm. You see neighbors doing it, you see the Association doing it, you see things that have been done… And people are 'Oh, I'm gonna do it too.'

Grizzly Flat

Located less than 50 miles south of Auburn Lake Trails in El Dorado County, Grizzly Flat is a collection of 580 homes with no formal government or organizational structure located in a dense mixed conifer forest. Grizzly Flat had a reputation as an "outlaw community" with an anti-authority counter culture. As one resident described it:

> The thing…when we moved here fourteen years ago, it was… There were five hundred houses and there were five hundred bunches of people living independent of each other… there was nothing, community-wise.

This type of community is a challenge for efforts to build capacity for collective action. As one resident saw the challenge:

> Well, first off, you've got to go after people according to the way they function. Like I said, you live in a community like this, basically [there are] a lot of mountain men. You know? It's a wild area. 'Don't bother me, if I want that bush growing into my window, it's going to grow into my window.' That kind of a thing. So I think the group has to understand who they're dealing with. Also the biggest thing here is because we're a bunch of independents, we aren't going to go out and tell somebody what they're going to do. But we're not shy about telling them what needs to be done. And then say to them, 'Hey, you've got to do

this, so go find a way to get it done.' But we're not going to tell them how to do it, it's just not going to work for this particular community.

Although covenants, conditions and restrictions were written when the area was developed, there is no enforcement mechanism, no property owners association or other organization like that in ALT.

The culture of the community started to change in the 1990's when more retirees and part-time residents started moving to Grizzly Flat to live next to neighbors who had originally come to the area to avoid nosey neighbors and escape government interference. These new residents brought with them their expectations of what a community should be, not only in terms of services provided but also in terms of residents' ability to work together. One of the big concerns of residents was fire protection. One Grizzly Flat resident commented:

> …the fire district was pretty ineffective… things were starting to fall apart, [the CDF] was having troubles… So it's… we were talking about trying to improve the fire prevention, the fire fighting."

Much of this talk occurred at Friday "burger nights" organized by one particular resident during the summer months. The organizer described these functions as follows:

> We started this thing going with a hundred people at these burger night things, and we'd just go and say, 'Hey, on Tuesday night we're going to sit down and talk about the following…'

The El Dorado County Fire Safe Council director encouraged residents of Grizzly Flat to get involved and hired consultants to work with the community. Those involved in developing the Grizzly Flat CWPP see their document as the community's tactical

plan in support of the strategic county plan. Being surrounded by national forest lands with high fuels loads, residents felt that they were "literally right in the muck…" Local residents formed a Grizzly Flat Fire Safe Council and worked with the consultants to address local concerns in the CWPP.

Grizzly Flat residents framed the wildfire issue first as an evacuation problem, and the consultants worked with the Fire Safe Council to develop a CWPP that addressed this issue:

> I and several others said you need to just set this evacuation route to the shortest route, no sense running it around the block if you can go straight across. So that was the kind of thing they did. They knew what needed to be done, they just needed to know where it was going to happen, and we needed to understand why they would chose to do what they were doing.

Although development of alternative evacuation routes has been slow, the CWPP has produced a team of local residents who work with their neighbors to reduce hazards in the home ignition zone, following recent state-wide regulations:

> We have here a defensible space team that goes around and helps people understand what the law, what the California law says."

The community is encouraged by the progress they are seeing and the Grizzly Flat Fire Safe Council is taking on other issues, unrelated to fire, that community members want to address:

> "I can tell you, it is the closest thing to a city planning committee you ever saw in your life. Because we do things that have nothing to do with firefighting… It's now at this point, we invite people, you got anything going on in the community

that's bugging you, come to our meeting and talk about it… It doesn't have anything to do with fire. If the Fire Council thinks it's a pretty good idea to chase… we chase it. And we've had really, really good luck at it."

The process of developing a CWPP in Grizzly Flat resulted in more than fuels management or reducing structural ignitability, but produced a community:

So I think it has just brought…a sense of community. We don't have a city government, but it's a sense of community. "

Discussion

The data from these two California communities illustrates some of the diversity in the social context, and thus adaptive capacity of WUI communities as it relates to wildfire protection planning. The two communities reviewed here are very different in terms of formal organization, socio-economic characteristics, and patterns of social interaction. While in ALT the wildfire-relevant social interactions revolved around the formal structure of a well-funded property owners association and activities association with the VIP program, in Grizzly Flat social interaction was almost non-existent until new residents brought with them expectations regarding what it means to be a community and took steps to increase informal interactions and civic engagement via the burger night tradition initiated by one resident. In each case we see that the existing social adaptability and diversity of these two communities dictated the different approaches to wildfire protection planning. The Grizzly Flat example in particular points to the concept of community as an evolving process. The CWPPs developed for both communities address wildfire risks in the local surroundings, with contractors bringing the scientific knowledge necessary to assess risks and develop projects to modify risks. The process used to

develop the CWPPs reflected the values and social contexts of each community. ALT residents are accustomed to hiring professionals to carryout projects and they trust professional judgments to be accurate and appropriate. People did not feel it was their place to questions the contractors' professional judgment regarding the prioritization of wildfire projects in the ALT CWPP or to introduce local knowledge. In Grizzly Flat the CWPP process not only addressed wildfire management needs identified by the community, but also helped build community capacity to take on new projects not necessarily tied directly to wildfire. Neither contractor produced a cookie-cutter solution to the CWPP challenge, but both worked to meet community expectations and to build on or improve elements of community context.

From this data and the literature we suggest that effective policy and resource management in and around communities comprising the WUI necessitates that we first know the social context of these communities, focusing on elements such as informal knowledge networks, access to scientific/technical information networks, demographic/structural characteristics, and place-based knowledge they bring to the table. To accomplish this we argue for a synthesis of social understanding that can adequately make sense of the WUI, a "new species" of human habitation that marks a change in the way people interact with and live on the land. The WUI is complex because its porous social, economic and political boundaries allow increased interaction between vastly different segments of society and at a variety of spatial scales. Seasonal homeowners from urban areas now live next door to those with traditional ties to resource extraction; average household incomes, education, or ecological knowledge among residents of nearby communities may vary dramatically; local political systems and infrastructure of some communities may incorporate differing levels of bureaucracy, local knowledge or capacity to enact change.

We argue a more complete understanding of the WUI should combine relevant aspects from the literatures described above. The conceptual elements we introduce not only help explain previously identified linkages between demographic/structural characteristics and community complexity or resilience, but the informal knowledge networks and relationships to place that are not so easy to quantify. Take for example the proximity of a community to public lands or a regional city (Jakes and others 2003; 2007b; Flint and others 2008). Both elements clearly influence the character of such a community. Similarly, the presence of local community organizations such as Firewise, volunteer fire departments or increasingly specialized fire prevention districts (Nelson and others 2003) are clearly linked to local action and knowledge that is so central to Wilkinson's Interactional approach to community.

Other aspects contributing to social complexity in the WUI are elements linked to both conceptual bases included in this paper. These elements include the income or education levels of residents (Walker and others 2006; Winkler and others 2007) or economies currently or recently supported by resource extraction (Flint and Luloff 2005). For instance, some work indicates that seasonal homeowners are often less apt to work collectively within their communities and place a high value on retaining the aesthetics of an area rather than reduce fuels (Bright and Burtz 2006)

Perhaps more importantly, our grounding in the above-discussed conceptual perspectives allows us to identify and help explain intangible elements of community agency and adaptability. As we suggested in the introduction, adaptive capacity for dealing with a variety of issues related to proximity or connections to wildlands, including knowledge networks, are an undervalued and underrepresented portion of community resilience that our conceptualization can add to the larger discussions of hazard management (Berkes 2007). Wilkinson's (1991) notions of

interactional fields of community and locality are the basis for the continuing process of community development, the maintenance of local knowledge about hazards and other potential challenges. Each of these aspects contributes to whether residents can collectively mobilize resources to prevent, mitigate or recover from hazard events such as fire. Thus, increased adaptive capacity will help create more resilient communities.

The recognition of difference in WUI communities and the additional diversity uncovered by our previous perspectives create a gradient of social conditions within its borders. This gradient is not unidirectional across the landscape, but will most likely result in a mosaic of local adaptation and culture. Our perspective does not disregard all traditional notions of rural and urban, nor does it attempt to place "tidy" boundaries around them; rather, it suggests additional layers of complexity in existing theory and spatial arrangement to reflect changing American settlement patterns. Such a perspective allows us to view how the physical environment and community ability to mobilize collective resources interact to influence their abilities to prevent, mitigate and recover from hazards.

The argument we have made in this paper is largely conceptual. However, we suggest it is conceptualization for a very practical end. A great deal resources have been spent in recent years developing policies and programs to help WUI residents deal with wildfire risk and other challenges faced in the WUI. These policies can have a variety of outcomes and local communities adapt national goals to local needs. We believe the time has come to more systematically document the actual needs and existing capacities of WUI communities. The conceptual understanding that we have suggested here is a useful starting point for the empirical investigation of these needs and capacities. The end result would be the selective targeting and distribution of scarce resources to areas where they are most needed.

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CHAPTER 6:

ALTERNATIVES TO EVACUATION DURING WILDLAND FIRE: EXPLORING ADAPTIVE CAPACITY AND INCORPORATING SOCIAL DIVERSITY

There has been much debate in recent years over how to best protect human populations and property at risk from intensifying wildfire events. Historically, U.S. agencies and land management professionals had a relatively simple answer to this question: suppress all fires quickly to keep them from impacting human settlement and evacuate populations when that could not be accomplished. The latter half of this philosophy clearly reflected and substantiated the preference for evacuation that remains central in the U.S. approach to disasters (Pyne 2001; Wisner et al 2004). Yet the law does not require residents to evacuate during *most* instances of wildfire or other hazard events (Mozumder et al 2008; Wolshon and Marchive 2007). Thus, private citizens have always faced a personal decision of whether to comply with evacuations or remain to ride out the event. There is a long history of cases during wildfire events where residents have chosen the latter (Cova et al. 2009; Cohn et al. 2006).

More recently, fire professionals and researchers from multiple countries have questioned whether evacuation (or "relocation" as many now prefer) is always feasible or preferred as a strategy for protecting human life and property during wildfire events. The outgrowth of this thinking has been the development of various *alternatives to evacuation*. Australian authorities adopted a policy of "Stay and Defend or Leave Early" (hearafter referred to as "SDLE") that supported resident decision to remain at home during wildfire events provided that their homes were adequately prepared to withstand a wildfire event and that they could actively defend against the fire (Rhodes and Handmer 2008). Likewise, U.S. authorities have considered a

number formal strategies that would prepare residents to remain at home or in designated shelter areas during certain wildfire scenarios. These include versions of Australian alternatives, more passive shelter options such as shelter-in-place (SIP) or specially designed sheltering points (Paveglio et al. 2008; McCaffrey and Rhodes 2009).

Research on the biophysical conditions surrounding what is needed for preparing and implementing alternatives to evacuation during a fire event has been relatively well researched (i.e. appropriate home construction materials, residential vegetation standards, etc.) (Gill and Stephens 2009; Cohen 2008). In this paper we respond to numerous calls for research on the *social* characteristics of communities necessary to support alternatives to evacuation, thereby advancing the discussion of their place in fire management (Cova et al. 2009; Stephens et al 2009). Little empirical research has attempted to uncover the factors which lead to interest or successful implementation of alternatives to evacuation, including resident responsibility, awareness and preparedness. The few examples that do exist suggest that the social and physical factors supporting alternatives to evacuation differ among communities and need more exploration at the local level. It is at this local level where research attention to local experience and community capacity can provide a better picture of what is necessary to advance fire protections, including alternatives (Paveglio et al in press; Steelman 2008). For this reason our case study research of Wilderness Ranch, Idaho, treats alternatives to evacuation as one strategy that can help achieve the U.S. goal of "fire adaptive communities" outlined in the Quadrennial Fire Review (USDA and USDI 2009). We use a recently developed framework of the social factors that influence community ability to reduce impacts from fire events to better understand how the local context of a given community allows or hinders the development of alternatives to evacuation for application during fire events.

Alternatives to Evacuation—An Evolving Discussion

Defining alternatives to evacuation

Alternatives to evacuation encompass a broad class of activities that vary in their formality and practice given different local social conditions, such as agency policies (i.e. fire district, county and city fire departments) resident awareness or ability to reduce fire risk, and site-specific biophysical factors (i.e. fuel loadings, aspect, and vegetation). A number of specific strategies that fall within the category or alternatives have been discussed in professional and scholarly literature, including SDLE, SIP and "sheltering points" (Handmer and Tibbits 2005; Gill and Stephens 2009).

The primary difference between the SDLE and other alternatives to evacuation is the level of resident involvement during the hazard event. All three measures require proper vegetation management in the structural-ignition zone and fire-hardened (or "ignition resistant") construction, yet SDLE maintains that resident efforts to combat the fire prior to and following the flame front are needed to ensure human safety and structural protection. SIP is a passive process in which residents take refuge during the entire duration of the fire. Specially designated "sheltering points" other than homes (i.e. community center, disaster shelter, school gym) are another option that can include either passive or active component depending on the construction of the structure (Paveglio et al. 2008; Rhodes and Handmer 2008). For the purposes of this discussion, we will use the term alternatives to evacuation to describe the broad class of practices that provide residents *the choice* to remain in a fire-hardened structure during the pass of a flame front and the opportunity to (often) put out preceding or subsequent spot fires.

The consideration and implementation of *formal* policies concerning alternatives to evacuation is a relatively new phenomenon for communities in the United States. Only a handful of communities have considered or implemented *site-specific* alternatives as a strategy for dealing with wildfire risk to human settlements. While the alternatives employed in these communities share broad commonalities, differences exist in the policies and procedures designed to prepare the landscape (i.e. buffer zones, building codes and vegetation management standards), structures and residents (i.e. outreach materials, presentations, training) for their implementation (Rancho Santa Fe Fire District 2009; Firewise Communities 2009).

Consideration of alternatives to evacuation in the U.S. is influenced by more developed practices in Australia ("Stay or Go") and long-standing American sheltering procedures for short-duration hazards such as chemical spills and tornadoes (National Institute for Chemical Studies 2009). The Australian strategies have a long history of development and refinement that recently went through another round of review following the Black Saturday fires of 2009, the country's second worst natural disaster in terms of lives lost (Teague et al. 2009*a*). We will review this progression below.

Australian Alternatives

Despite long-standing traditions of remaining in homes and other structures during wildfire in portions of Australia, consideration of organized policy concerning alternatives to evacuation is generally ascribed to the period following the Ash Wednesday Fire of 1983. It took many years to garner support for an official policy (Handmer and Tibbits 2005). Research on the Ash Wednesday Fire and others (Wilson and Fergeson 1984; Parliament of the Commonwealth of Australia 2003) led to the development of the SDLE policy, also referred to as the "stay or go"

model in Australia (Rhodes and Handmer 2008). The SDLE model was eventually adopted by The Australasian Fire Authorities Council and the Bushfire Research Center, with both organizations developing outreach materials on the preparations necessary for resident safety (Bushfire CRC 2006; Australian fire Authorities Council 2005). Evidence suggests that many Australians in rural areas have used the practice to protect both themselves and their property. However, the dynamic nature of wildfire conditions make standard recommendations by professionals concerning SDLE difficult (when and in what conditions to implement). Likewise, there is far from uniform understanding or implementation of the policy by residents (Tibbits and Whittaker 2007). Others have noted that women and families are more likely to favor evacuation, with able-bodied men the most common family members that might stay to defend property (Proudley 2008). Both patterns are evident in U.S. experience with alternatives to evacuation (Paveglio et al in press; Cova et al. 2009).

The tone of discussions concerning SDLE in Australia changed in the wake of the tragic February 2009 "Black Saturday" fires in that country. Review and revision of the SDLE policy was a major focus of the Royal Commission convened following the widely publicized event. The commission concluded that information central to the SDLE policy (i.e. when to evacuate, adequate protections) was not detailed enough to ensure the safety of residents (Teague et al. 2009*a*). They recommended the revision of outreach materials communicating the SDLE policy, a reinforcement that "the safest option is always to leave early rather than stay and defend," and additional professional authority to advise residents on the "defendability of their homes." The new mantra of this revised policy approach is "Prepare. Act. Survive."

An additional fire danger rating beyond the current limit of "extreme" was recommended to reflect the extraordinary conditions (i.e. weather and dry fuels) which fed the Black Saturday

fires, with residents strongly advised to evacuate on "catastrophic" days regardless of their plans to stay and defend. The first use of the "catastrophic" or "code red" warning occurred in November 2009, though there is some indication that certain residents chose to remain (British Broadcasting Corporation 2009).

More recent recommendations advocated further research on community refuge areas or private "fire bunkers" as viable alternatives to evacuation and proposed initiatives aimed to construct such shelters in at risk communities. These conclusions were a positive note in an otherwise critical discussion of alternatives to evacuation (Teague et al. 2009*a*; Teague et al. 2009*b*).

U.S. Debate over Use of Alternatives

The past five years have been marked by increasing consideration and debate over the use of alternatives to evacuation in a U.S. context (McCaffrey and Rhodes 2009), though earlier pioneers do exist (Oaks 2000). Among the significant concerns to implementation are the social prerequisites (i.e. communal commitment to uniform fuels reduction, standards or policies for building and zoning), psychological preparedness of residents and sustained educational efforts needed to prepare the average homeowner to effectively use such procedures (Stephens et al 2009; Paveglio et al. 2008). Likewise, two significant points of debate among professionals and scholars concern the role of alternatives in the established corpus of firefighting priorities (primary, secondary or last resort strategy for life safety) and their applicability to various populations at risk for fire (isolated communities, subdivisions, elderly or young) (Cova et al 2009).

McCaffrey and Rhodes (2009) and Paveglio et al (in press; 2008) have both discussed the organizational challenges inherent in changing the evacuation practices of the highly standardized U.S. organizations tasked with wildfire management and the added level of complexity given their operation at various scales. More recent work has expanded these discussions by demonstrating that many professionals are actually supportive of efforts to develop alternatives to evacuation and that those with experience in both wildland and structure fire events see the most utility in the practice (Paveglio et al in press; Cova et al 2009).

Cova et al. (2009) discussed the considerations surrounding both resident and professional use of alternatives. They developed early decision-action trees for consideration of alternatives of evacuation during various wildfire conditions and local contexts (i.e. available ingress, egress, proper vegetation management). According to these authors, alternatives to evacuation are most pressing among those populations where the minimum amount of time needed to evacuate is high due to infrastructure (poor road conditions, traffic) constraints.

Other authors exploring the applicability of SDLE in the U.S. note that improvements in tools used to predict possible fire impacts or determine the timing of mass relocations during fire events (i.e. "trigger points," fire modeling, rate of spread models) could eventually provide professionals and residents the means to better assess the safest strategy during a given fire situation (i.e. evacuation or shelter) (Gill and Stephens et al 2009; Stephens et al. 2009; Wolshon and Marchive 2007). However, they also point out that such models cannot make absolute predictions of fire severity, nor would they be easily adopted or interpreted by the residents. As such, more work is needed on how to make such models more accurate and applicable to decision-making regarding alternatives to evacuation.

Based in part on the above research, consideration and implementation of alternatives to evacuation appeared to be on the rise in the U.S. preceding the Black Saturday Fires of 2009. However, high profile consideration of such alternatives in Southern California was abandoned by officials in that region shortly after the Black Saturday Fires (FIRESCOPE 2009). These same professionals unveiled the alternative policy of "Ready, Set, Go!" shortly thereafter. "Ready, Set, Go!" retains a primary focus on ignition-resistant structures and reduction of fuels in the home ignition zone in an effort to create housing developments that can survive fires without local residents present and are safe for firefighters. Rather than emphasizing alternatives, in this policy *early* evacuation is characterized as "the preferred and safest option for all residents;" sheltering strategies are advised only when residents are trapped by fire (Roper 2009; Ventura County Fire Department 2009). The "Ready, Set, Go!" policy has received support from the U.S. Western Fire Chiefs Association (Aleshire 2009) and the International Association of Fire Chiefs (2009), with plans to expand its use across the nation.

A Framework for assessing ability to develop alternatives to evacuation

Fire policies have generally treated the WUI as a homogeneous collection of people and human systems, with little recognition of the social complexity and variability that affects policy implementation. This is not representative of a recent body of research that suggests that some communities have greater capacity to adapt to environmental disturbance through planning, mitigation actions or recovery initiatives (Sturtevant and Jakes 2008; Norris et al 2008; Adger 2003). The recent focus on *adaptive capacity* among scholars studying environmental hazards and climate change recognizes the differing ability of communities and the need to better understand local social context in designing behaviors aimed to reduce risk. Adaptive capacity is

the ability or preconditions of a social system that allows it to adjust to environmental changes through the mobilization of resources (social, economic, organizational) (Nelson et al 2007; Berkes 2007).

Our conceptual emphasis centers on a recently developed framework that synthesizes adaptive capacity and social science literature on wildfire management (Paveglio et al 2009). These authors introduced four broad and interacting elements of local social context which are seen to influence community ability to perform collective actions that reduce wildfire risk, mitigate its impacts, or help communities adapt in the recovery process. These elements include: (1) Access and ability to adapt scientific/technical information to a local context; (2) Resident knowledge of the local ecosystem and experience with wildfire; (3) Interactions and relationships between local residents that can lead to collective action; and (4) Demographic (i.e. median income, age, ethnicity) or structural characteristics (i.e. road infrastructure, building materials, access to resources).

The argument made by Paveglio et al (2009) is that various combinations of the above characteristics can help explain what fire protective actions local populations are able to conduct. Their comparison of two Californian communities' ability to create Community Wildfire Protection Plans draws parallels to other fire studies documenting regional and community differences among WUI residents' support of fuels management (i.e. thinning, prescribed fire, smoke impacts), implementation of fire protections (i.e. reducing fuels in the home ignition zone, building standards, and zoning) and willingness to comply with mandatory evacuation (Bowker et al 2009; Mozunder et al 2008; Brunson and Shindler 2004). Similarly, the emerging research on alternatives to evacuation that we reviewed above indicates that some communities may be more capable of developing or implementing alternatives than others based on both social and

physical characteristics (Roper 2009; Paveglio et al in press; Cova et al 2009). Our research seeks to expand our understanding of community adaptive capacity to wildfire and the conceptual model created by Paveglio et al (2009) by uncovering the specific community characteristics that facilitate consideration of alternatives to evacuation.

Methods

Site Selection

Few communities in the U.S. have implemented alternatives to evacuation, though a number have expressed interest in the subject. Thus, our site selection began by identifying any U.S. communities that were considering or implementing such measures. Possible case study sites were identified by contacting national and regional professionals and conducting Web searches for outreach materials or news media coverage on alternatives to evacuation. Lexis-Nexis searches for newspaper coverage of the topic were also conducted.

The relatively small list of possible case study communities resulting from the above searches was further refined by selecting on the basis of the following characteristics: (1) How far along the community was in actually implementing a formal alternative to evacuation (beyond the interest stage); (2) The amount of local interest and involvement in the development of alternatives; (3) Whether the study area represented a WUI community and finally; (4) Whether the community existed outside of the urban fringe.

The last three of these considerations were important in our consideration of communities beyond the suburban boundaries of urban areas. Evidence from the U.S. and other countries (Australia and Canada) suggests that these populations may be more likely and capable of remaining at home or nearby during the pass of a fire (McGee et al. 2009; Lindroth and

Livermore Fire Protection District 2005). They are also populations which may have more difficulty evacuating given the condition and infrastructure of rural road systems.

The senior author made contact with local community leaders or fire professionals in four communities that met the above criteria. The intent was to determine whether the on-the-ground reality of local fire planning actually matched the materials we gathered from the sources above. Wilderness Ranch, Idaho, was chosen as the study site because its local fire district had distributed information to residents in support of alternatives to evacuation and was in the process of developing formal recommendations to advance this planning.

Case Study Community Description

Wilderness Ranch is a collection of 270 homes (995 residents) founded about 20 years ago and scattered along 25 miles of dirt and gravel roads about 24 miles northeast of Boise, Idaho. Although close to the State's capital and major urban center, Wilderness Ranch does not share the resources and government infrastructure found in Boise. The Wilderness Ranch Owners Association (WROA) is responsible for collecting fees for maintaining the roads and other infrastructure and sets architectural and building standards for homes in the community. There are only two points of ingress and egress for Wilderness Ranch, and both connect to the two-lane Highway 21, a designated scenic drive and the only major road that links Boise and Idaho City. The local topography is rugged and mountainous, with vegetation on the bordering public land (Idaho Department of Lands (IDL), USDA Forest Service (USFS) and Bureau of Land Management (BLM)) shifting from shrub-steppe and grasslands to thick ponderosa pine and mixed conifers forests as elevation increases.

Wilderness Ranch was one of the first communities recognized by the Firewise Communities USA Program. Local volunteers still conduct regular Firewise meetings, organize collective fuel reduction efforts and assess local protections under the program. Local firefighting capacity in Wilderness Ranch includes the Wilderness Ranch Fire Protection District (WRFPD), which is supported by property taxes levied against property owners in the area and comprised of three elected fire commissioners, and The Wilderness Ranch Fire Fighter's Association, a nonprofit agency staffed by volunteers and funded by annual fundraisers, donations or government grants. The Association has a roster of more than 40 volunteer firefighters who regularly train and respond to fire or other emergency events along Highway 21 and other nearby communities. The aforementioned federal and state agencies have a mutual aid agreement with the Wilderness Ranch Fire District to respond to wildfires in the area (WRFPD 2008). The most significant firefighting presence is a Forest Service station (including hotshot crews) located 18 miles north in Idaho City.

Alternatives in Wilderness Ranch

Although the concept of alternatives to evacuation has been evolving in Wilderness Ranch, one element has remained consistent: the decision to evacuate or stay and defend during a wildland fire is made by the local residents—it is their choice. Outreach material provided by the WRFPD and WROA contain elements of the three approaches described earlier, with the terms SDLE and SIP used somewhat interchangeably. The emphasis in outreach information is on the active suppression of spot fires prior to and following the flame front by residents who have not evacuated. While materials developed early on focused on alternatives as a way to ensure both home and personal safety, more recent information has concentrated on life safety:

> "Some residents in our communities have the option of remaining in their homes during a fire...The main purpose of stay and defend is to preserve life safety, not to save houses and the possessions they hold..." (WRFPD 2008 p. 1)

The WRFPD and WROA provide "Stay and Defend," "Home Defense" and "Firewise" checklists outlining the actions residents must take to implement an alternative to evacuation and the local physical characteristics that would make such alternatives applicable to them. The WRFPD advises residents living in areas where staying in their homes would be dangerous due to biophysical conditions (i.e. high fuels, increased slope, canyons) or the absence of ignition resistant construction (i.e. shake roofs, wood siding) that they will soon also have another choice: "Refuge Houses" or "Sheltering Points." Owners of safe, defensible properties will identify their home as a refuge house and allow other residents to shelter there during a wildland fire rather than evacuate.

Data collection and analysis

Understanding how social elements influence the development of alternatives to evacuation necessitates a qualitative inductive approach. This is because such research is in its exploratory stages: few empirical themes or patterns provide the basis for testable hypothesis on the subject (Glaser and Strauss 1999; Strauss and Corbin 1990). During the summer of 2008, the senior author conducted 50 semi-structured, face-to-face interviews with individuals who either live in Wilderness Ranch, have had interactions with residents concerning wildfire events, or who might be responsible for overseeing fire protections in the area. Emergency managers interviewed included leaders and members of the volunteer fire district spearheading the development of alternatives, fire professionals from the BLM, US Forest Service and Idaho Department of Lands, and local emergency planning professionals. Interviews took place in

residents' homes, at community gathering places, or professional offices throughout the area. All interviews were recorded and later transcribed.

A combination of theoretical and representative sampling was used to select study participants. Theoretical sampling is an approach in which subjects are selected not randomly, but rather on the basis of their knowledge or experience in a particular domain (Lindlof and Taylor 2002). This method was important in our selection of local leaders (i.e. Wilderness Ranch Fire District Chief, local Firewise representatives) and area professionals (i.e. IDL fire managers; USFS) who may have specialized knowledge about wildfire planning or the applicability of alternatives to evacuation in Wilderness Ranch. Representative sampling was employed in the selection of local residents who embodied the range of perspectives surrounding fire protections and alternatives to evacuation. In this case, care was taken to interview residents who live in different geographic locations in the community and representativeness was monitored by recording the location of interviewed residents' homes on a map of the development. Consistent with an inductive approach, data collection in both sampling strategies continued until the authors in consultation with key informants agreed that emergent patterns had stabilized and no novel information would be forthcoming from later observations (Glaser and Strauss 1999).

Data analysis consisted of analytic induction and thematic analysis using the Atlas-Ti v.5 software for Qualitative Data. Often closely tied to grounded theory and the constant comparison method, analytic induction is primarily concerned with providing data-driven explanations of phenomena (Ryan and Bernard, 2000; Silverman 2001). Patterns identified from initial interview notes are later refined through continual testing against any new observations, a process referred to as "progressive falsification" (Strauss and Corbin 1990).

Thematic analysis serves as a complementary coding strategy to analytic induction because it identifies commonalities in interviewees' experience surrounding a given topic (Boyatzis 1998). Using the Atlas Ti v. 5 software, the senior author: (1) Coded similar statements into categories reflective of observed patterns in the data, a process dubbed the "discovery" stage by Maykut and Morehouse (1994); (2) identified any observed anomalies or apparent contradictions in these emergent patterns (3) Presented these initial themes and examples to co-authors in order to standardize or reject observations (inter-coder reliability) emerging from the data; (4) Selected the most representative quotations of remaining themes through multiple stages of increasingly restrictive coding. This coding strategy can standardize the categories developed in analytic induction by providing a systematic way to support or reject themes based on their reoccurrence in the data (Boyatzis 1998; Silverman 2001).

Results

Our results revealed a number of community characteristics that appear to have prompted or supported development of alternatives to evacuation by local residents and volunteer fire professionals. We have organized the presentation of these various characteristics within the conceptual elements outlined in Paveglio et al's (2009) framework of adaptive capacity to wildfire risk in an effort to illustrate how our findings both substantiate and extend their work. While the adaptive capacity framework recognizes that many of these social characteristics interact and could apply to multiple elements, we have made the effort to situate characteristics under the most applicable of their four elements.

Place-Based Knowledge/Experience

Resident Awareness, Ability and Preparedness—We observed a relatively high level of local awareness of wildfire risk among our interviewees. Residents understand that fire is a regular occurrence in their local ecosystem and something they have the responsibility to personally prepare for. Awareness of wildfire risk and the choice to live a more rural way of life has caused many residents to develop the physical skills necessary to manage their properties, including brush clearing and tree felling. The ability to control fuels in the home-ignition zone was often most pronounced in long-term residents of the area and those who could describe experience with previous wildfires in the area. As one resident said: "...Like hurricanes in Florida, its fires up here, and I try to keep the brush cut back, I've been cutting brush back for 20 years up here..."

The portion of residents we spoke with in Wilderness Ranch were also aware of local efforts to promote alternatives to evacuation and had personal plans in place for a fire situation. Residents informed us that they had decided to remain in their houses or those of neighbors during the event of the fire, and could articulate the actions they had taken (i.e. fuel modifications, ignition resistant construction, experience with fire support) or would take (i.e. putting out spot fires, evacuating to safer homes/areas in the ranch) to implement them. As one resident said:

> "Absolutely, it would be my preference (to stay)...a worst case scenario, about the worst I can think of would be if somehow a limb went through the window...I think that's extraordinarily unlikely, I mean this is heavy double-paned or up here triple-paned glass...so my view is we would be perfectly fine anywhere in the house and certainly in that root cellar, you know, where its 55 degrees and its surrounded by dirt and then we'd come out and you know, if we needed to fight a little fire, we would."

Other residents were aware of the option to remain, but reported that they would choose to evacuate early if the option was available to them. Many of these interviewees reported that their (or their neighbors') local conditions (i.e. vegetation management, house location) or personal ability (i.e. willingness to accept risk or put out fires) were not sufficient to stay.

Local Independence and "Anti-Authority"— Beneath the very specific characteristics described above is an underlying community trait that contributed to both interest and preparation for alternatives to evacuation among residents. This is perhaps best described as a "self reliant" or "anti-authority" culture that causes local residents to pursue solutions they can manage themselves. As one resident described: "I mean the people who live out here are fairly independent, self-sufficient, you know. Nobody, including the fire, is gonna shove me around."

This anti-authority mentality meant rejecting "cookie cutter" approaches to housing development, fire standards and evacuation mandates in other parts of the country. Many residents referenced California explicitly in these comparisons. According to one resident who is also a commissioner for the WRFPD: **"**Again it's a choice: I'm gonna stay and defend. I don't need the government telling me whether I can or can't do that. And I think we probably see a lot of that, you know, within the area."

Access to Scientific/Technical Knowledge Networks

Firewise Communities Program— The long-time association of Wilderness Ranch with the Firewise Communities USA Program was described by interviewees as one critical characteristic underlying resident ability to reduce wildfire risk, thus laying the groundwork for alternatives to evacuation. As one resident articulated: "If we can continue to do the Firewise, I

think more people will have the confidence to stay...if you are gonna try to hold out, you've got to do the job, you've got to do the Firewise to bring the intensity down."

Key individuals in the community had made great effort to access Firewise information concerning fuel reduction and construction materials in the home ignitability zone and educate residents about Firewise standards. As one resident said: "We have as much risk as anywhere in the state, it's just, most people here are a lot more aware...and most people do try and take care of their places...and (name) does a fantastic job going around and promoting information about being Firewise."

Members of the community conduct regular Firewise meetings at a communal building in Wilderness Ranch to discuss personal fire protections and plan collective fuel-reduction programs (see below). Homes that have achieved Firewise standards or with exceptional fire protections are often featured in the Wilderness Watch, an online and paper newsletter developed by residents. Periodic articles in the Watch have also focused on the personal choice to employ alternatives and how Firewise preparations can help residents prepare for this possibility.

Professional Input on Fire Protections—Regional fire professionals and emergency managers were uniformly supportive of efforts to develop alternatives to evacuation. As one BLM fire specialist explained: "There certainly is information out there and if there is a point person who's willing to take the time to learn about it (alternatives), I think it is a viable option." As is discussed below, interaction with fire professionals from the U.S. Forest Service, Idaho Department of Lands and other agencies were often the basis for increased awareness of limited ingress/egress or additional training for volunteer firefighters. Both factors were critical precursors to support and development of alternatives.

The professionals we interviewed acknowledged that Wilderness Ranch had been proactive in taking steps to reduce their fire risk and considered many sections of the community "defendable" enough to allow consideration of alternatives. As USFS fire specialist and incident commander explained:

> "Quite a few of those homes are, not in timber, not in dense timber, you know. They got fairly open space, light fuels, roadways, you know, if they've been landscaping their property with you know, at least 30 to 50 feet of green grass all around it and sprinkler systems and whatnot, they could actually stay."

When queried about what is needed to effectively implement alternatives to evacuation in Wilderness Ranch, the state, county and federal professionals we interviewed indicated additional information sharing between their agencies and the local leaders of the WRFD and WROA. This included a more accurate understanding than currently exists of who and how many people intended to remain during a fire situation, a continued focus on fuel-reduction programs and the possibility of further consultation with wildfire professionals concerning expected fire intensities.

Demographic and Structural Factors

Limited Evacuation Capacity—Local leaders of WRFPD and the WROA were well aware that the road infrastructure in Wilderness Ranch contributed to an even higher wildfire risk for community members and decreased likelihood of successful evacuation. This came from review of wildfire risk by experts (including local USFS fuels managers and USFS scientists) and local resident experience. As a number of local firefighters and community leaders

described, the diminished capacity to evacuate was one of the primary reasons to explore alternatives to evacuation:

> "We gotta try to get 270 homeowners out this one road when I'm trying to get engines up to the fire, think about the liability we've got by not having a plan at all and just hoping everybody gets the hell out of here... so we need to look at alternatives and I recognize that there's some risk involved to it, but I just see it as the only solution to our unique problem here at Wilderness Ranch."

Perhaps more interesting was the widespread recognition of this diminished evacuation capacity among local residents and its citation as a primary reason for their interest, consideration or support of local efforts to develop alternatives. Many residents described the dangers they would likely face attempting to evacuate, even early, given the poor road infrastructure and likely traffic on Highway 21:

> "I know enough of the people here that I'm not sure if we tried to evacuate we could, the roads are essentially one lane and when people get crazy, I wouldn't want to be fighting the roads. I'd rather take my chances and be here (home), particularly as you go down some of these roads, you're much more in a canyon and will get toasted there."

Identification of Sheltering Points—Interestingly, efforts to create "sheltering points" emerged early in the consideration of alternatives to evacuation at Wilderness Ranch. As a local volunteer firefighter explained: "There are certain houses that are gonna be much more defendable than others and so yeah, I went through the Ranch and found several that, you know, one in each area that would work (as a sheltering point)." This realization became obvious to local leaders and residents after viewing the contrast in vegetation throughout the Ranch (grasses and ponderosa

pine savannah vs. northern portions of thick forest vs. scattered canyon areas) and consulting with other fire professionals in the area (i.e. USFS, IDL). Residents we interviewed mentioned where their nearby "safehouse" was and the understandings between neighbors. However, local leaders acknowledged that the program had "fallen off somewhat" in that continued interaction between residents and information about sheltering points was not being up kept. More recent publications by the WRFD indicate that planning for the use of such "safehouses" has returned in order to adapt alternatives to the physical diversity of fuel loadings in the Ranch.

Diverse Resident Backgrounds—Many residents of Wilderness Ranch are not the typical "mountain-folk" often envisioned by those invoking the stereotypical residents of more "rural" communities. There is actually a great deal of occupational, economic and social diversity within the community primarily because of its proximity to Boise and its role as a bedroom community to that city and home to high-tech entrepreneurs working from home. Professions range from highly skilled and educated business and government professionals to construction workers and mechanics. This diversity was very important factor in the relationships between residents in regards to fire protections.

Interactions/Relationships Among Residents

Community Interaction to Address Common Concerns—The diverse skills and abilities of residents from the disparate groups described above is one important factor in support for alternatives to evacuation and the ability to carry out the actions (fuel reduction, structure protection) that predicate their use. As one resident pointed out in regards to the planning or implementation of fire protections: "I think it's a nice mix up here, you've got people willing to

do some hard work and you've got people who are willing to sit down on the computer and we've got enough diversification where there is a lot of talented people."

The professional skills residents bring to their community support the writing of grants for projects to reduce fire risk and development of outreach materials to educate their neighbors. Meanwhile, longer-term residents have more experience and ability to carry out fuels reduction, on personal or collective property, can operate machinery to that end, or have knowledge of wildfire risk specific to the local ecosystem. Other residents have former ties to law enforcement or firefighting, which made them easy sources of information. As one resident pointed out, "The guy that lives right over here is a retired sheriff...and I talked to him about it and he said you'd be better off to stay in your home rather than try and get down."

The ability of many residents in Wilderness Ranch to work together and support one another appears to be borne partially from the common hardships of living in a mountainous area (heavy snows or wildfire risk). This ability to work together is also a critical factor in the success of many local organizations and fire programs, including the WRFPD, the local Firewise group and the WROA. For instance, Wilderness Ranch organizes a yearly cleanup/fuel reduction day each spring and has created drop-off zones for collective brush removal from the Ranch. The community has received grants through state and federal programs to reduce fuel loadings on private and common property. The WROA also sells Barricade Fire Gel to residents looking for added protections. Another resident described support for local firefighters at their annual fundraiser and picnic, which also serves as a forum to educate local residents about wildfire risk and (more recently) the option for alternatives to evacuation:

"People were just dropping money, you know...that was people just coming out from this community just to say thank you...you're part of this community, and that to me said something huge about the sense of community and how people will come together when the time comes."

This ability to work together is often most focused among small groupings of the community, as the Ranch is often "segmented" into smaller "neighborhoods" by the topography. These smaller "micro-communities" and the familiarity between residents within them were the basis for the "sheltering points" alternative. Likewise, volunteer firefighters often served as sources of information among these groupings. As one resident explained:

> "Yes, I know every neighbor here compared to when I lived in the South, or in Simi Valley, I couldn't tell you the persona that lived right next to me...for the most part everybody has their own little clique and that's for sure, but then again, we try to be friendly with every neighbor up here...if anybody gets in trouble or anything like that, it's not like being in the city where you get a 5 minute or less response time, so everybody kind of relies on everybody up here...

However, it is important to note that the level of involvement by residents across the ranch was not uniform, and that some members of the community were critical of others' (often newer residents') abilities to deal with wildfire risk. As one resident with fire plans in place (sheltering point) articulated: "This winter was alarming to me on the amount of people, the percentage of people that live up here that cannot take care of themselves so I think it's frightening what you're looking at in terms of a plan or the prospect of people stay."

Local Firefighting Capacity Supported by Community Volunteerism— Residents had great respect for the efforts and training of local volunteer firefighters, many of whom were also

heavily involved with the WROA. As one resident said: "Just a bunch of guys that were either in their retirement age or good volunteer firemen or whatever, but they got great training...and they come to parties and we talk about the stuff (fire protections)." This respect for local firefighters and the regular interaction among firefighters and members of the *community* was a significant factor in the dispersal of ideas concerning alternatives to evacuation and resident trust in the opinions of firefighters who supported the concept.

Wilderness Ranch has taken a number of steps to improve its firefighting capacity, including expansion of the Wilderness Ranch Firefighters Association, establishment of the WFRD, and continual training for volunteer firefighters who live throughout the development. Local leaders also explained that support for this training often came through partnerships with nearby USFS or IDL offices and state or federal grants. But as a number volunteer firefighters and local leaders described, along with these improvements in firefighting capacity has come a broader realization of the risks the community faces and the limits in firefighter ability to protect property and lives, both of which lead to consideration of alternatives to evacuation.

Mobilization by "Local Champions"— In addition to local volunteer firefighters, a group of highly involved and motivated local leaders emerged to champion the idea of alternatives in Wilderness Ranch. These individuals included an organizer of Firewise programs and a handyman/community organizer who helped spearhead fuel reductions projects across the community. The respect and influence these individuals had on the community was a critical factor in the promotion and planning for resident use of alternatives. As one of these local champions described: "As long as we have the 'dirty dozen' that will kind of organize and kind

of put the word out...probably 5% of the community can get the rest of the community to help out, but it takes that 5% to rally the troops."

Discussion

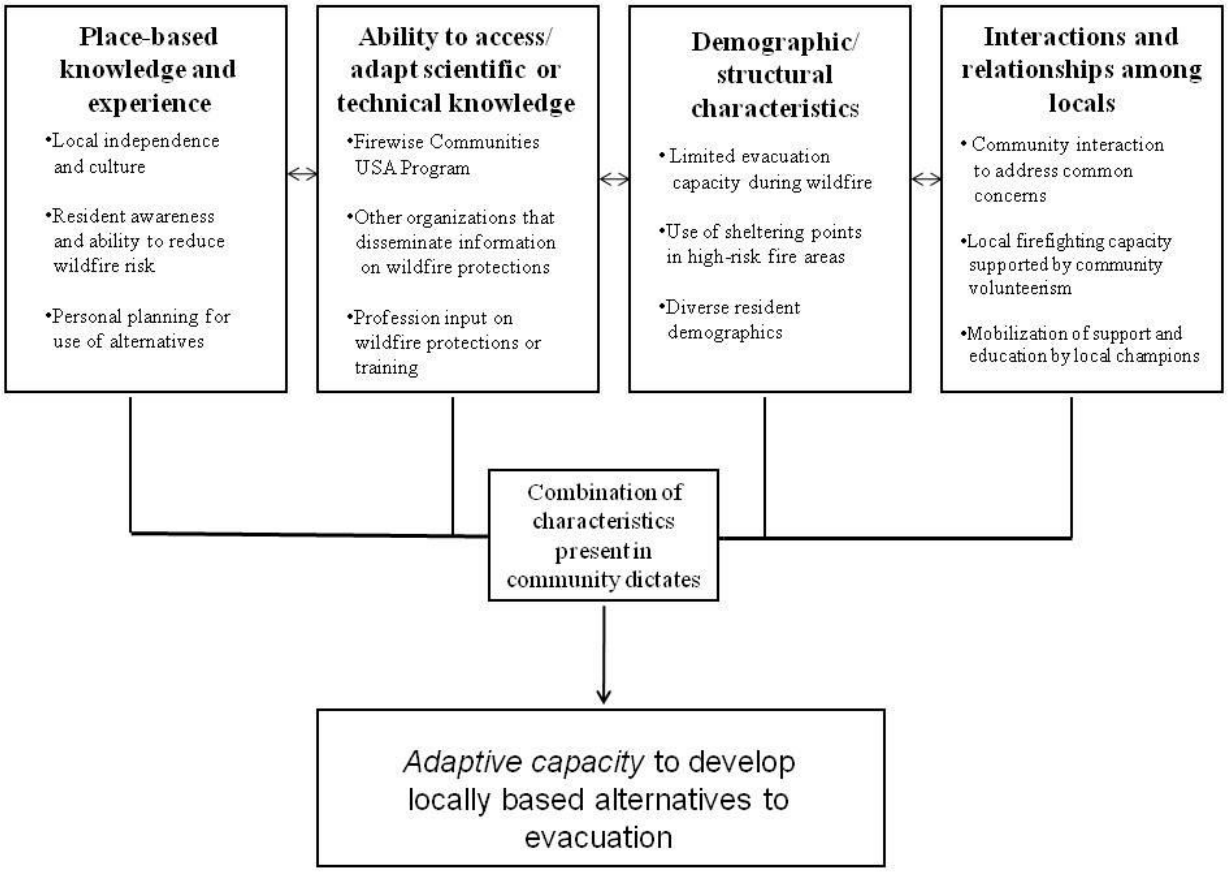
"It's not all about technology...sometimes it's common sense. I'm sure barricade (fire-retardant gel) works real well, but you know what else works well? A 5-gallon bucket of water..."

Calls to local leaders in Wilderness Ranch in January 2010 indicate that they will continue to support the use of alternatives to evacuation in Wilderness Ranch and disseminate information on residents' choice to do so. They are pursuing additional options for fuel reduction on common or private property and assessing the viability of sheltering points in different areas of the development. Yet it is important to point out that the alternatives being discussed in Wilderness Ranch are not a policy, they are merely a suggestion in which the responsibility lies with the individual resident. There is no formal request that residents evacuate or employ a particular type of alternative, nor is this likely to change as a number of residents indicated they were unwilling or incapable of carrying them out. Rather, the suggestion that residents could possibly prepare themselves to use alternatives is an extension of informal practices that have long been considered a voluntary *option* by (mostly rural) residents in the United States and Australia (Handmer and Tibbits 2005; Naiatka and Mutch 2008). Our use of the adaptive capacity framework helps us better understand the social factors which led to local interest in alternatives to evacuation and resident planning to use them in this particular setting.

Applying the Adaptive Capacity Framework in Alternatives to Evacuation

Our research on the social characteristics which supported the development of alternatives to evacuation among local residents in Wilderness Ranch, Idaho, is only one case study. However, the in-depth nature of that study is a step in understanding the ways communities are progressing toward being "fire adapted" and the identification of locally based community characteristics that make such adaptation possible. To that end we attempted to situate our findings within an adaptive capacity framework designed to identify the broad social elements that dictate variable community ability to adapt or act in the face of wildfire risk (Paveglio et al. 2009). We found that the specific characteristics uncovered in this study could all fall within one of the four categories identified in the framework. As we will discuss below, each characteristic was an important factor in the support and development of alternatives, one "fire adapted" behavior that could help reduce fire risk (Figure 1). Perhaps more importantly, it can be seen how the factors within each conceptual element interact with others, creating a local context shaped by a number of social factors. These findings lend credence to the conceptual framework developed by Paveglio et al. (2009) and extend it by suggesting particular community characteristics which could be used as indicators of ability to act in the face of wildfire risk or specific characteristics that can help predict where interest in alternatives to evacuation may occur.

Figure 1—WUI adaptive capacity and community characteristics Influencing the development of alternatives to evacuation during wildfire



Revisiting the four factors of the adaptive capacity framework, we can discuss how the presence of specific community characteristics led to interest and support for alternatives to evacuation among residents in Wilderness Ranch. For instance, the growing recognition of lacking infrastructure and ability to evacuate among local leaders was a critical factor in initial interest of alternatives (Cova et al 2009) while the variable local conditions (i.e. fuel loadings, housing construction, location) led local leaders and residents to adjust what alternative they would use (sheltering points). While both of these characteristics are predicated on physical (structural) factors, it is the recognition and knowledge of how they impact wildfire risk to human communities that served as the basis for action. Meanwhile, the diverse social, economic

and professional backgrounds of those in Wilderness Ranch gave them the basis for a wide range of collective abilities to reduce fire risk and advance planning for alternatives to evacuation. Such abilities have been observed in other studies of fire risk (Jakes et al. 2007; Steelman 2008) and included the securing of grants or dissemination of knowledge and the skills necessary to reduce fuel loadings or conduct fire suppression. However, this factor could also be a detriment in some cases if residents with diverse backgrounds cannot agree or work together.

In regards to place-based knowledge and experience, our results suggest that many residents of Wilderness Ranch choose to live the local setting to be free of regulations dictating what they can and cannot do. This includes the freedom to remain in their homes or nearby shelters during fire situations and taking pride in their independent ability to deal with their own risk. Experience with and knowledge of the local ecosystem has caused many residents to become aware of wildfire danger and seek out information. Others have developed the skills or implemented the behaviors necessary to reduce fire risk, including fuels reduction, building construction, planning for alternatives to evacuation, or joining the volunteer firefighting effort. Similar results have been reported by others studying fire preparedness (Carroll et al 2004; McCaffrey 2006). All of these factors are crucial antecedents in the ability to carry out alternatives to evacuation, should they become necessary.

Also contributing to the awareness wildfire risk and the knowledge of how to mitigate it were the various avenues local leaders and residents of Wilderness Ranch used to adapt scientific or technical knowledge in the pursuit of alternatives to evacuation. The people we interviewed consistently mentioned the importance of expert consultation and professional input. For instance fire professionals were instrumental in recognizing the limited evacuation capacity of Wilderness Ranch and providing training to local volunteer firefighters. On the other hand, leaders in

Wilderness Ranch have yet to collaborate with local fire professionals (IDL, USFS, BLM personnel) or provide them with information about the alternatives they intend to implement (i.e. maps indicating who intends to stay, "sheltering points"). This collaboration could strengthen their planning and reduce risk for residents and firefighters.

A number of residents we interviewed noted how the long-time success of the Firewise Communities USA program and community organized efforts surrounding it have made some residents capable of maintaining the physical protections necessary for alternatives to evacuation and confident enough to plan on using them. We would suggest that Firewise is not the only point of access for such information, as other organizations (Firewise Councils; volunteer firefighting organizations, county emergency initiatives) could just as easily provide a similar role in other communities.

Perhaps the least tangible characteristics linked to successful community adaptation surrounding wildfire risk is the interactions and relationships among local residents. However, we would contend that the ability of residents to pursue solutions to common problems and help each other deal with risk is a highly influential force grounded in multiple literatures (Flint and Luloff 2005; Beckley et al. 2008; Nelson et al 2007). In Wilderness Ranch, familiarity with immediate neighbors and regular interactions were borne of shared community challenges such as road travel during the winter and fire risk. Many of these interactions are informal, but that makes them no less important in collective preparation. For instance, these interactions laid the groundwork for the interest in sheltering points, in which some residents would use others' homes as refuge during a wildfire situation.

Organizing in the form of the WROA, WRFPD, volunteer fire department and Firewise chapter also demonstrate more formal ability to work together and the importance of community

volunteerism. The fact that residents are willing to donate their time, energy and efforts to the improvement of local ability to reduce fire risk in Wilderness Ranch or suppress it where necessary demonstrates a commitment to collective action. Likewise, the development of formal organizations provides the opportunity to set common standards for fire protections, mandate fire-adaptive behaviors or organize action. The WROA mandates certain building materials and architectural covenants, though they are far from the restrictive codes mandated to reduce wildfire risk in many Californian communities. While development of additional community standards may conflict somewhat with the "anti-authority" mindset described above, collective discussion and agreement on such standards might alleviate the perception that outside entities are dictating the specific forms of adaptation.

Finally, the important role of local champions we observed in Wilderness Ranch mirror other results (Firewise 2009; Paveglio et al. in press), indicating that community interest and support of alternatives is often borne first by a select few in a given area. These individuals serve a critical role in overcoming the historical conception of evacuation as the safest option during fire by researching and adapting ideas to the local context. Their ability to command local respect and mobilize action appears to be a factor in the adoption of ideas such as alternatives.

Social diversity and alternatives to evacuation

The characteristics described above are not likely be present in every WUI community at risk from wildfire, nor will the relative strength of these characteristics be uniform, even in communities with relatively similar demographic attributes. However, we would suggest that some of the above community characteristics, and others yet to be identified, could eventually serve as indicators for community capacity to reduce wildfire risk. Such advancement would

require consideration of how to measure each of these specific characteristics and the type of data local, state or federal agencies could collect to assess the variance of this ability across diverse WUI communities.

The point here is that there is no one combination of local resources is likely to predicate development of alternatives to evacuation (or other fire adaptive behaviors), be they place-based (i.e. local ecological knowledge, including fire ecology), informational (i.e. local firefighting training, professional consultation), demographic/structural (i.e. ingress/egress, local wealth) or predicated upon the interactions and relationships residents have with one another (ability to achieve common goals, communal/familial ties). Rather, combinations of the above described elements in a local context (and others yet to be defined) seems highly likely to influence which alternative (or alternatives) to evacuation is best suited for the population and their ability to implement it (Figure 1).

Another critical factor in the development of alternatives to evacuation is the physical considerations regarding predicted fire spread and severity (fuel types/loadings, slope, aspect and weather). Where a community might lack structural or material resources, they may supplement it with local ability, knowledge and collective planning. This was the case with Wilderness Ranch. The converse may also be true. Similarly, local biophysical context (high expected fire severity) and social ability (planning, likelihood of collective action) may both influence the protective approach to fire (i.e. sheltering points, mandatory evacuation of some areas). Unfortunately, very little research has focused specifically on the biophysical conditions necessary to allow for the use of alternatives to evacuation. This includes such factors as the effect of radiant heat on residents' taking refuge in structures with various construction materials. Likewise, greater understanding is needed concerning the local physical conditions (fuels,

topography, protections) that would influence the safe employment of alternatives to enhance life and property safety without exposing residents to additional harm (Stephens and Gill 2009; Cohen 2008; 2000).

Early comparison of our results in Wilderness Ranch to those of more affluent communities on the suburban fringe (Paveglio et al in press; Rancho Santa Fe 2009) suggest that the divide between suburban populations and other, more "rural," communities in the WUI may yet be an important force in understanding the ability to develop alternatives to evacuation or carry out other adaptive behaviors. WUI communities existing outside the suburban fringe, often characterized by larger parcels of land more interspersed with wildland vegetation or with less population density, have been called the "exurban" or "rural" communities by geographers (Stewart et al 2007; Platt 2010; Travis 2007). For instance, our results and those of others (McGee and McFarlane 2009; McCaffrey 2006) demonstrate that "rural" populations often have increased awareness, responsibility and ability to reduce fire risk due to their experience with local ecosystems characterized by high levels of wildland vegetation. This is most pronounced among long-term residents. Likewise, both our research and prevailing notions in rural sociology demonstrate that communal ties and ability to address collective problems are often more pronounced in such areas (Flint and Luloff 2005). "Rural" populations of the WUI are also less likely to expect the types of government services (i.e. local fire protections, road maintenance or other services) found in suburban areas (Jakes et al 2007; Carroll et al 2004). Regulation of wildfire planning or associated standards may be another matter, however. Most importantly, these populations often have poor road infrastructure or capacity to evacuate, nor are they likely to accept any one policy which dictates that they evacuate or remain in their homes during fire situations (Cova et al 2009; 2005). Recognition by residents of these transportation limitations is

more likely to engender interest and action among local populations because it is a *necessity* for life safety rather than another planning option for life *and* property safety.

We are not arguing that alternatives to evacuation will not work in the suburban fringe; nor are we saying that such communities could not demonstrate the social characteristics listed above. Rather, we are suggesting that the alternatives employed for these populations may be different (i.e. more passive options such as SIP or sheltering points) if the appropriate social and physical standards are not present. To that end, our extension of the adaptive capacity framework developed by Paveglio et al (2009) is starting point in the exploration and recognition of the conditions that will drive whether and what type of alternatives are necessary in a given community. Acknowledgement of the conditions that allow adaptive capacity is part of a larger understanding that WUI communities are a diverse collection of social, cultural and political entities that vary in their ability to reduce their wildfire risk and increase their resilience to various disturbances (fire, climate change, drought). Perhaps the most important facet of this work, and the basis for targeted distribution of resources (i.e. education, grants, planning) to improve capacity is the systematic documentation of these various social capacities and local physical conditions (Paveglio et al 2009; Adger 2003). More specifically for alternatives to evacuation during fire, this means additional exploration of the various methods employed by residents, how (or whether) they are able to implement them, and the development of agency competency in *facilitating* (rather than dictating or deciding) what type of alternative will work in each situation. Likewise, it is imperative for residents to understand that alternatives to evacuation are not a uniform solution to wildfire risk—certain local conditions (both social and biophysical) will reduce their effectiveness. Failure to consider the variable applicability of

alternatives could expose residents to additional harm and open the door to the liability claims that often influence fire professionals' decisions regarding wildfire management.

The challenge of safely evacuating WUI residents at risk from wildfire will only continue to grow in the future. The continual expansion of the WUI and "exurbs" into increasingly rugged terrain with heavy vegetation virtually ensures it. We would claim that for some, evacuating in a safe and timely manner is already infeasible. Other research and experience demonstrates that some populations would now *prefer* to stay as a measure of life safety, to avoid the disruption caused by evacuation, to protect their homes, or as a combination of all three (Cohn et al. 2006; Mozumder et al. 2008). This increasing interest and awareness in the inevitably of fire risk is something that fire professionals cannot ignore.

Just as the WUI can no longer be considered one "type" of community, fire professionals cannot expect that one uniform solution to fire risk (evacuation or alternatives) will work in each situation. Rather, we need to engage the (admittedly) messy business of helping residents determine what their existing ability to deal with fire risk is, how they can build it, and whether they are best suited to remain or evacuate in various fire situations. This means providing information on the variety of options available to residents, developing tools and training that help them take on this additional responsibility, and (in some ways) stepping back from the role as "expert" protectors in lieu of a community resource.

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