

Information, Resources, and Management Priorities: Agency Outreach and Mitigation of Wildfire Risk in the Western United States

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States in the American West are experiencing significant population growth and exurban development, in addition to a longer fire season and a changing climate. These factors contribute to the increasing difficulty of managing wildfire in the Wildland–Urban Interface. Using data collected through a survey of fire professionals, this research investigates the strategies that agencies use to promote wildfire mitigation on private property within the WUI, fire professionals' sense of the effectiveness of those strategies, and support among fire professionals for various regulatory approaches to wildfire mitigation. The findings indicate that fire professionals are keenly aware of the constraints imposed by the political context and acceptability of some tools that they could use to promote more aggressive mitigation on private property. Recommendations based on these findings suggest that fire professionals should consider capitalizing on citizen network approaches to outreach in order to build trust between agency personnel and homeowners and to cope with limited support for regulatory mandates for wildfire mitigation.

KEY WORDS: risk policy and management, risk communication, risk perception

Introduction

States in the American West are experiencing significant population growth and exurban development in the Wildland–Urban Interface (WUI), defined as the areas “where humans and their development meet or intermix with wildland fuel” (USDOI and USDA 2001, pp. 752–753). Due to a century of fire suppression policy, along with persistent drought conditions, the western United States has recently experienced some of the biggest and most severe wildfires in history (National Interagency Fire Center, 2014; Litschert, Brown, & Theobald, 2012). A study by Westerling et al. (2014) found that wildfire in federally managed forests across the western United States has grown substantially in recent decades, “with large (>1000 acre) fires in the decade through 2012 over five times as frequent (450 percent increase) and burned area over 10 times as great (930 percent

increase) as the 1970s and early 1980s" (p. 81). With growth in development expected to continue on fire-prone landscapes (Gude, Rasker, & van den Noort, 2008) as well as the potential for climate change to affect fire severity (Hessl, 2011), it will be increasingly important to mitigate wildfire risk in the WUI. Much of the literature investigating issues related to wildfire risk mitigation on private lands has focused on individual homeowners' mitigation efforts and their perceptions of risk (e.g., Brenkert-Smith, Champ, & Flores, 2012; McCaffrey, Stidham, Toman, & Shindler, 2011; Syphard, Brennan, & Keeley, 2014). However, the crucial role that fire management agencies and wildfire professionals play in assessing risk and promoting mitigation on private property has garnered less research attention.

Increasing wildfire mitigation on private property in the western United States is a challenge faced by many fire agencies and jurisdictions. While government-mandated regulations related to wildfire risk mitigation, such as building ordinances or development restrictions, are used in many communities across the West to help mitigate wildfire risk, these approaches may not address preexisting built structures or be politically tolerated in some communities. Consequently, fire professionals¹ may promote other risk mitigation strategies such as voluntary mitigation efforts and incentive programs. Often faced with limited resources and constrained by the need to divert funds earmarked for mitigation to wildfire response (Paul, 2014), agencies must determine the most effective ways in which they can encourage individual actions that will increase collective wildfire risk reduction through mitigation efforts on private property.

Using data collected through an online survey of fire professionals in the western United States, this research investigates the approaches that fire professionals use to promote wildfire mitigation and risk assessment on private property within the WUI, fire professionals' sense of the effectiveness of those programs, and support among fire professionals for various regulatory approaches to wildfire mitigation. The results of this study indicate varying agency outreach approaches with regard to promoting wildfire mitigation in WUI communities, diversity in the channels used to disseminate that information, and variance in agency priorities with regard to wildfire mitigation on private property. The findings also indicate that fire professionals are keenly aware of the political context and acceptability of certain regulatory approaches to wildfire risk mitigation within communities where their agencies operate. The findings presented here are useful to scholars in understanding management strategies and preferences, and also to fire professionals seeking to target the most effective mitigation outreach approaches for their local communities.

Collective Action and Wildfire Prevention and Response

Collective action scholars grapple with the paradox that, even when groups of people share a common interest in a public good, the collective provision of that public good is likely to be stymied by individual incentives to "free ride" on

the efforts of others (Olson, 1965). A public good is a commodity or service that people cannot reasonably be prevented from using (non-excludable) and that can be consumed by many people at once (non-rivalrous). In situations where individuals might receive the benefit of a public good without bearing the costs, they have an individual incentive to enjoy those benefits without contributing to providing the good. This incentive grows with the size of the group and the scale of the public good. At least since Hardin's (1982) analysis of the Prisoner's Dilemma, scholars have investigated the sanctions or incentives required to alter the cost-benefit calculations of groups and their members, enough to encourage co-operation (Taylor, 1987). Studies have found success in collective action under two scenarios: (i) when the benefits of cooperation are high relative to the costs of participation, and (ii) when levels of trust between stakeholders are high (Costanza, Low, Ostrom, & Wilson, 2001a, b; Ostrom, 2001; Zellner et al., 2009). Trust between citizens and agency personnel is an aspect of overcoming collective action dilemmas in wildfire that will be discussed below.

Wildfire risk mitigation and wildfire response can both be considered public goods. When agencies, organizations, or individuals undertake wildfire risk mitigation projects, other nearby residents cannot be excluded from enjoying the associated risk reduction (Stidham, McCaffrey, Toman, & Shindler, 2014). When a wildfire does occur, wildfire response agencies conduct suppression efforts to protect properties without consideration for which properties conducted adequate mitigation (without jeopardizing firefighter safety, which is the foremost goal of fire professionals) (National Wildfire Coordinating Group, 2014). As no one can be easily excluded from enjoying the benefits of wildfire risk mitigation or response, residents may be more likely to free ride on these benefits than to actively contribute to the provision of them, making both wildfire risk mitigation and response collective action problems (Gardner & Cortner, 1988; Winter & Fried, 2000). When government regulations for mitigation are not present, are not politically feasible, or are insufficient to promote wildfire mitigation among homeowners, professionals working to promote wildfire risk mitigation on private property in the WUI must consider whether incentives or mandates that levy sanctions² are most appropriate to encourage individuals to participate in mitigation activities on their own property. Such institutional efforts are not fail-proof, however, and are frequently hampered by WUI residents' perceptions that disaster recovery assistance, fire insurance, and firefighting programs are substitutes for on-the-ground hazard mitigation on their properties (McKee, Berrens, Jones, Helton, & Talberth, 2004; Collins, 2005, 2008; Winter & Fried, 2000). In the context of wildfire mitigation programs, incentives might take the form of grant programs for homeowner mitigation, while sanctions include tools such as fines or fees when residents fail to mitigate.

Wildfire professionals face additional barriers to collective action on wildfire risk mitigation efforts beyond classic free-riding behavior. Wildfires do not heed jurisdictional boundaries, making wildfire risk mitigation a multi-jurisdictional problem (Davis, 2001) that encompasses both private lands (including individual lots and privately held conservation areas) and public lands of all types (city,

county, state, tribal, and federal). The associated political and jurisdictional fragmentation can pose significant challenges to promoting collective action among disparate and dispersed properties (Zellner et al., 2009).

For instance, federal land management agencies have historically managed wildland fire on public lands. Given increasing population growth in the WUI, however, state and local government agencies increasingly share the responsibility of fire mitigation with private property owners. While these various agencies may share the common mission of managing wildland fire, both in terms of mitigation and suppression, their values, policies, and approaches to achieving their mission may be quite different. Thus, it is challenging to institute a unified plan regarding wildfire risk mitigation in many WUI zones (Reiners, 2011).

The WUI is also culturally, socially, and politically diverse within single jurisdictions, and even within neighborhoods. The myth of WUI communities as cohesive units of residents who know each other, work together, and share similar attachments to the land has been proven overly simplistic (Cortner, 1991; Lee, 1991). Residents in the WUI have diverse aesthetic and environmental values, think about “living in the woods” in different ways, have varying perceptions of the hazards posed by wildfire, and make different trade-offs between the potentially conflicting values of wanting to live within forested wildlands and the associated risks to life and property inherent in that choice (Daniel, Weidemann, & Hines, 2002). Agencies that promote mitigation of wildfire risk must grapple with these complicating factors as they work to encourage individual mitigation actions among WUI residents. As indicated above, many strategies have been used to overcome the collective action problem inherent in wildfire mitigation efforts, such as incentives, sanctions, and regulations. However, if agency personnel are to directly engage with residents to persuade them to mitigate, the literature suggests that some degree of trust building must take place. This is discussed in the following section.

Engaging Citizens in Wildfire Risk Mitigation

Wildfire mitigation is one area in which management plans and policies must necessarily incorporate the knowledge and preferences of local citizens, particularly in geographic areas where public and private lands intersect. This process includes building trust between citizens and agency personnel in order to develop connections that may help agencies effectively communicate with individual homeowners to potentially increase agency effectiveness with mitigation outreach. But mitigation planning also requires highly specialized technical information on fire behavior and management (Anderson, Hodges, & Anderson, 2013), which may make the process less accessible to citizens. For example, although the National Fire Plan developed in 2000 mandated a more collective approach (i.e., public involvement) to wildfire planning processes, this transition was challenged by “historical institutionalism,” or the idea that institutional arrangements established in the past influence and even dictate decisions made under current management regimes (Cheng, Steelman, & Moseley, 2007; Orren & Skowronek,

2004). Furthermore, as Reiners (2011) notes, agencies are constrained by other factors: resources, geography, and inadequate processes for incorporating stakeholder or citizen input. These limitations challenge the ability of managers to pilot engaging interactions with the public beyond the one-way information stream of a public meeting, for example.

A survey of citizen responses to agency efforts to educate and solicit input on fuels management projects found that public meetings actually rated *last* in terms of effective outreach methods. Local citizens instead preferred interactive formats, such as conversing with an expert or participating in field trips (Toman, Shindler, & Brunson, 2006). Social networks also play an important role in the dissemination of information and its relationship to action. Brenkert-Smith, Dickinson, Champ, and Flores, 2013 found that both “vertical” (i.e., expert information sources and formal interactions) and “horizontal” (i.e., non-expert information and informal interactions) interactions correlate with heightened wildfire risk perception among WUI residents. Talking with one’s neighbor had the strongest positive relationship with perceptions of wildfire risk. Working to help residents understand their wildfire risk is central to motivating mitigation behavior change. These results indicate that top-down transmission of information is helpful, but “horizontal” social networks are also important. These interactive formats can provide fire managers a venue through which they can help establish trust with WUI residents while simultaneously sharing wildfire information, which as articulated above is crucial to overcoming the collective action challenges associated with motivating wildfire risk mitigation.

Trust is also an essential component of the relationship between agencies and local citizens in resource management. Citizens appreciate integrity and sincerity on the part of agency officials, as well as good communication and meaningful engagement in decision-making (Olsen & Sharp, 2013). Given that fire mitigation and fuels management in the WUI are likely to be of significant importance to both land managers and land owners, finding ways to genuinely engage private property owners in the mitigation process, and articulating their stakes in the outcomes (Lachapelle & McCool, 2005), should be a priority for agencies working to reduce fire risk on both public and private lands. Following the 2002 Hayman Fire in Colorado, Kent and Gebert (2003) found that among local residents “there was clear respect for individual Forest Service employees yet often a critical view of the Forest Service as an agency. . .[as] arrogant, disdainful of local knowledge, obfuscating, and mired in red tape” (p. 371), demonstrating that the individuals who live and work for agencies within a community may have more leverage in building trust and facilitating mitigation work than agency-distributed information and top-down agency directives.

The importance of trust also extends to community motivation for engaging in fire mitigation, which may be affected by the level of social capital present among community members. In a recent survey, Bihari and Ryan (2012) assessed the mitigation capacity of six communities at risk of wildfire across the United States. Findings indicated that in communities with higher levels of social capital or “community cohesion,” residents were more likely to be active in fire

mitigation efforts—both directly through fuels reduction on their own property, and through fuels management projects on neighboring public and private lands (Bihari & Ryan, 2012). Their findings suggest that fire professionals should capitalize on the attachments that local residents have to their particular community in order to accomplish fire mitigation goals at a broader scale than just individual properties.

As Putnam (2000) suggests, the development of social capital extends trust and cohesion between people and groups that may not normally interact. Furthermore, the value of practicing “participatory inquiry as a means of civic discovery” to address complex environmental problems can actually contribute to long-lasting relationships between citizens and experts (Fischer, 2000; p. 240) as well as long-term commitment to managing problems such as wildfire risk. In the case of wildland fire, a local citizenry engaged in productive relationships with fire professionals and experts, either at the individual or community level, can serve as a valuable tool in achieving mitigation goals on public and private lands.

However, the various agencies’ role in nurturing this relationship and promoting local engagement bears further exploration. Clearly, wildfire risk mitigation requires collaboration, cooperation, and trust between fire professionals and homeowners, and between homeowners themselves. How best to cultivate this dynamic is not fully known. Traditional regulatory, top-down, and highly technical approaches have been shown to limit the ability to build trust between fire professionals and communities. Therefore, more interactive and informal approaches to wildfire mitigation outreach may yield higher levels of trust and cooperation in the WUI. Understanding fire professionals’ support for and experience with various regulatory or incentive-based approaches to encourage wildfire mitigation may help us understand more about these dynamics. Additionally, there are increasing calls for regulatory approaches to managing wildfire risk in the West, and, therefore, understanding the support that wildfire professionals have for such approaches is important for learning how implementing agencies might view such approaches to risk reduction in the WUI.

Agency Outreach and Wildfire Mitigation: Research Questions

As described above, there are currently several gaps in the wildfire mitigation literature, including “assessing the role and contributions of local, state, and federal agencies in building and maintaining community capacity” (for wildfire-mitigation activities), and “examining the effect of variations in risk perception (public vs. agency and across cultural groups)” (McCaffrey, Stidham, Toman, & Shindler, 2013, p. 20). Attitudes, knowledge, and perceptions of risk by homeowners have been studied (e.g., Brenkert-Smith, 2011; Brenkert-Smith, Champ, & Flores, 2012), but assessing the strategies fire agencies and professionals use to promote mitigation action through channels that may include both incentives and sanctions, wherein agencies attempt to build trust and community capacity

toward risk understanding and mitigation, has not yet been adequately considered. In that vein, this research seeks to address the following questions:

RQ1: What approaches are agencies using to promote wildfire mitigation on private property, specifically with regard to sanctions, incentives, or trust-building approaches?

RQ1a: What approaches do residents seem to be most receptive to, according to fire professionals?

RQ2: What approaches are agencies using to assess and communicate wildfire risk to property owners and residents, specifically with regard to agency mandates versus voluntary risk assessment?

RQ2a: Are fire professionals' preferred approaches different from what is currently being used in practice?

RQ3: Which fire professionals are most likely to support regulatory approaches to wildfire mitigation and risk assessment, and do levels of support reflect personal opinions or professional experience?

Research Methods

This study employs a survey of fire professionals from the western United States. Prior to survey administration, comparative case study research of two Colorado communities affected by recent wildfire events was conducted (Koebele et al., 2014). Researchers conducted in-depth, semi-structured interviews (Rubin & Rubin, 2012) with key fire professionals ($n = 8$) in each case study community, covering topics such as agency outreach strategies and residents' perceptions of wildfire risk. Subsequently, researchers held focus groups with residents ($n = 12$) of the case study communities to gain insight into individual experiences with mitigation information dissemination, wildfire mitigation practices, and community planning performed by local fire agencies. The qualitative interview data were then used to inform an online survey questionnaire that was disseminated to a broad sample of wildfire professionals in the western United States in order to explore agency risk mitigation practices and opinions of the effectiveness of various risk reduction approaches beyond the two case studies, using Dillman's survey protocol (Dillman, Smyth, & Christian, 2014). In addition, researchers consulted with a fire management professional to ensure that questions were phrased in a manner consistent with common language used by fire professionals. These previous case study findings are cited in the context of survey results presented here when they provide useful comparisons with survey results.

Because there is no master list of fire professionals in the western United States from which to draw a survey sample, the researchers constructed a sample of wildfire professionals by first compiling a list of significant wildfire events³ beginning in 2012, resulting in 19 fires from eight western states: California, Colorado, Idaho, Montana, New Mexico, Utah, Washington, and Wyoming. Researchers then identified agencies that responded to these events and compiled a contact list of personnel at the agencies who work in fire management (i.e., not only fire responders). Contact information was obtained from Internet searches, documents, and phone calls made to agencies.

The survey was administered online to 499 potential respondents during two two-week survey windows during the summer of 2014. Two email reminders were sent to survey recipients during each survey window in an attempt to obtain a higher response rate, per Dillman's protocol outlined in his Tailored Design Method (2000). One hundred thirty-two surveys were completed, yielding a response rate of 26.5%. The survey instrument consisted of 48 questions grouped in the following categories:

- *Organizational type, function, and mission:* These questions ascertained what type of wildfire work the respondents' agencies engage in, on what types of land such mitigation is conducted, and how central mitigation and prevention is to the agency's mission. In addition, respondents were asked to describe their job responsibilities and how much time they allocate toward wildfire mitigation or mitigation promotion.
- *Strategies employed to promote and inform wildfire mitigation and risk assessment on private property and their perceived effectiveness:* These questions identified various mitigation practices in use, how mitigation is promoted, and what respondents' views are toward their effectiveness in reducing wildfire risk to properties and people.
- *How residents' respond to mitigation promotion and outreach:* While fire professionals may have one view of which strategies are most effective at encouraging wildfire risk mitigation among homeowners, residents' reception of these strategies may determine whether the strategies are actually effective on-the-ground. These questions, thus, investigated fire professionals' opinions about homeowners' receptivity toward various outreach approaches.
- *Values and opinions about who is responsible for wildfire mitigation in the WUI, and the nature of the WUI and fire risk in the area in which respondents work:* Professional experience influences how effective a fire professional feels a particular strategy is over another. However, professionals' personal values and opinions about broader issues such as the role of both government and the homeowner in wildfire mitigation and prevention and their feelings on wildfire management in general will likely also inform their views. These questions measured respondents' values and opinions on such issues.
- *Basic demographic information:* These questions measured past professional history, age, gender, education, and political affiliation. This information is important in understanding how past experience and demographics might influence respondents' opinions and beliefs. Questions regarding respondents' opinions about the appropriate role of government in regulating individual action, which are likely associated with political affiliation, were also included.

Table 1 provides demographic information on the survey respondents. While there are no reliable statistics on the wildfire profession (as opposed to the municipal firefighting profession, for example, where unions and demographers keep reliable data), the U.S. Bureau of Labor Statistics (2014) indicates that the firefighting profession as a whole is a majority male field and is aging.⁴ Moreover,

Table 1. Descriptive Statistics of Survey Respondents

Variable	Categories of Responses						Total
Age	26–34	35–54	55–64	65 or Older			
	6% (7)	69% (86)	24% (30)	1% (1)			100% (124)
Gender	Male	Female					
	82% (102)	18% (22)					100% (124)
Education	High School	Some College	College Degree	Graduate School			
	2% (2)	12% (14)	64% (78)	22% (27)			100% (121)
Years worked/fire	0–5	6–10	11–15	16–20	21–25	Over 25	
	3% (4)	8% (10)	16% (19)	19% (23)	26% (32)	28% (35)	100% (123)
Jurisdiction	Federal	State	County	Local	Tribal/ rural		
	54% (67)	24% (29)	10% (12)	7% (9)	5% (6)		100% (123)
Political affiliation	Democrat	Republican	Independent	Other			
	30% (31)	26% (27)	31% (33)	13% (13)			100% (104)

especially in the western United States where large tracts of land are managed by federal agencies, federal firefighting presence is significant. The political affiliation of these respondents also reflects the voter registration in several western states⁵ (Colorado Secretary of State, 2014). Overall, the demographics of the survey respondents do not appear to differ from what we would expect for this particular professional population.

Findings: Information, Resources, and Management Priorities

The goal of this research was to develop a deeper understanding of the approaches fire professionals use to encourage wildfire risk mitigation on private property, with the understanding that without addressing risk on private property, communities are not adequately reducing risk throughout the WUI. A majority (73%) of survey respondents indicated that encouraging wildfire mitigation on *private property* is either central to, or somewhat within, their agencies' missions. This analysis first attempts to understand what approaches these respondents use to accomplish these goals of increasing wildfire mitigation on private property within their jurisdictions:

RQ1: What approaches are agencies using to promote wildfire mitigation on private property, specifically with regard to sanctions, incentives, or trust-building approaches?

With the understanding that the majority of survey respondents focus on wildfire mitigation on private property, the various approaches and effectiveness of the approaches being used to encourage wildfire mitigation were analyzed.

Figures 1 and 2 illustrate the differences between the approaches used by fire management agencies to promote mitigation and the perceptions among fire professionals of the effectiveness of those approaches. When asked to rank their preferred approaches to encouraging wildfire risk mitigation on private property (Figure 1), professionals preferred methods such as outreach and education to encourage but not require mitigation (42%). It is important to note that only 21% of respondents preferred the more top-down approaches such as regulations or taxes and fees.

Further, when asked to focus on the category of outreach and education approaches, respondents were asked (i) how often their agencies used various approaches and (ii) how effective they seem for getting mitigation information to homeowners. The categories of “often” and “effective” in Figure 2 are sums of the Likert scale answers “somewhat often” or “very often” (=often) and “somewhat effective” and “very effective” (=effective).

While all outreach approaches are viewed positively by survey respondents, it is clear that agencies see face-to-face strategies, which typically include a fire professional going to a private property owner’s home and talking directly with

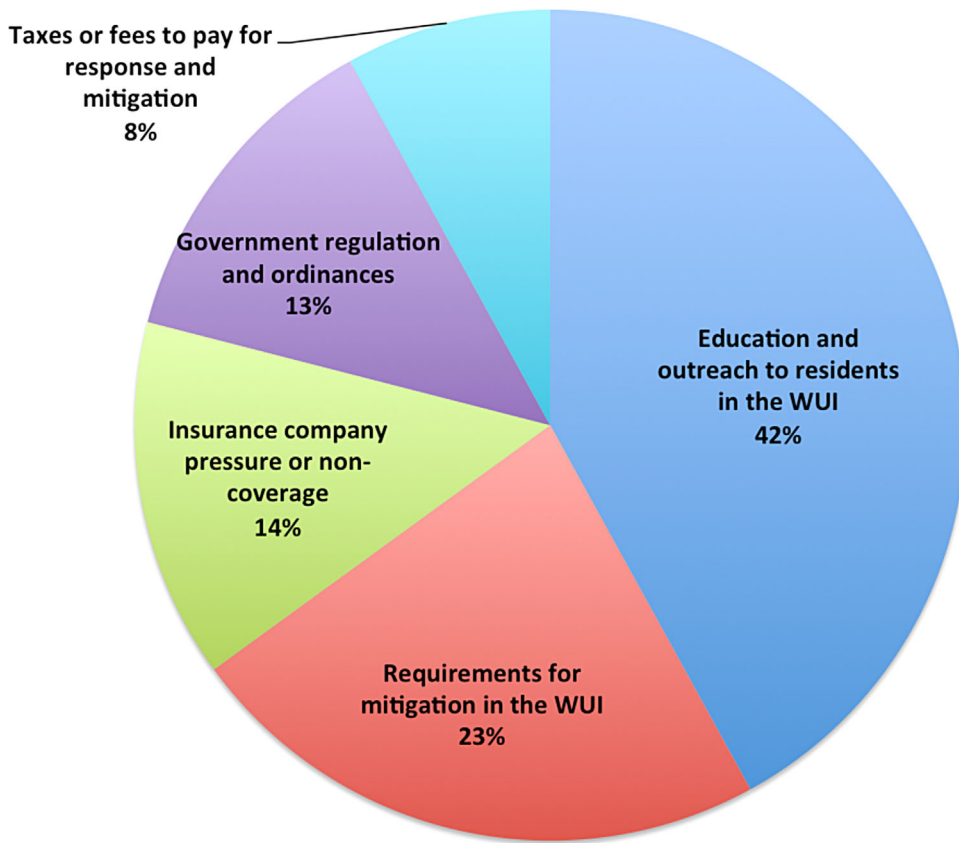


Figure 1. Preferred Approaches to Encouraging Wildfire Risk Mitigation on Private Property.

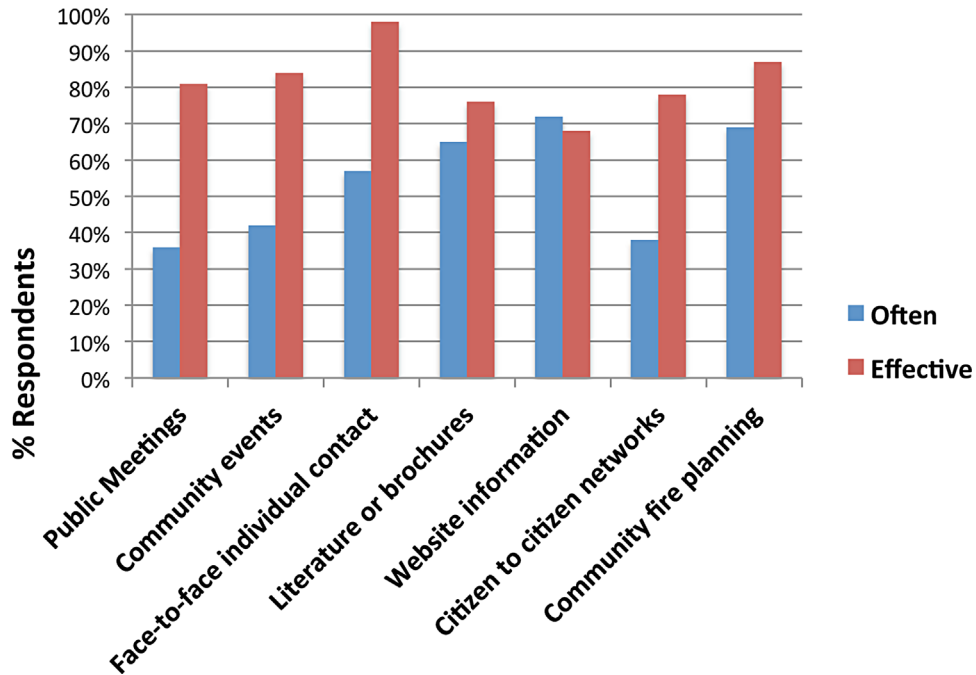


Figure 2. Effectiveness Versus Frequency of Use of Mitigation Outreach Methods.

them about how to mitigate on the property, as highly effective. This result supports previous findings about the effectiveness of face-to-face and interactive communication in trust building and effective agency management (e.g., McCaffrey, 2004; McCaffrey et al., 2011; McCaffrey & Olsen, 2012; Toman et al., 2006). On the other hand, website information and literature are seen as less effective than other approaches. This is consistent with other research indicating that citizens prefer interactive (rather than “unidirectional”) communication methods (Toman et al., 2006). However, fire professionals also rank these more passive methods as some of the most often used approaches to encourage wildfire risk mitigation, perhaps because of the issues associated with historical institutionalism discussed above (Orren & Skowronek, 2004).

These survey findings also support qualitative evidence gathered from previous case study research in Colorado. For instance, survey respondents ranked meetings and public events as slightly less effective than more direct or interactive approaches such as face-to-face contact or community fire planning. Interview subjects in the case studies indicated that meetings and events were useful for disseminating information, but that residents rarely attended them:

“It’s kind of ridiculous how little we get. . . we talk to other neighborhood champions who say the only contact they have is when they go door-to-door.”

"We held this event ...but we had only 100 people out of what—probably 1,000 people or more ... so a lot more of them could've shown up and should've shown up, but they didn't." (Koebele et al., 2014)

Furthermore, according to interview subjects, face-to-face contact or the use of neighbors to inform neighbors (called citizen-to-citizen networks in the survey questionnaire) was more effective uses of limited agency resources than public meetings and events, and were also perceived as being highly effective at encouraging mitigation activity by survey respondents (despite being used less frequently by survey respondents), which is consistent with other research evaluating fire mitigation outreach efforts (McCaffrey, 2004; Monroe & Nelson, 2004). While this type of network develops organically in many neighborhoods, one agency in a previous case study community (the Colorado Springs Fire Department) has institutionalized a citizen-to-citizen networking process through their "Neighborhood Champions" program, which deputizes motivated citizens to encourage their friends and neighbors to mitigate on their private properties and provides them with financial and technical support for organizing mitigation projects (Koebele et al., in press).

Beyond whether fire professionals view mitigation approaches and outreach strategies positively, understanding whether these professionals experienced positive or negative feedback from residents when attempting to encourage wildfire mitigation through these approaches is also important to understanding their success.

RQ1a: What approaches do residents seem to be most receptive to, according to fire professionals?

The regulatory option of ordinances related to mitigation was understood by respondents as negatively received by residents (only 47% of respondents had experienced positive responses from residents) compared with incentives (e.g., providing information about mitigation grant programs = 80% of respondents experienced positive resident responses) and information-based approaches such as assessing risk on properties (84% of respondents experienced positive responses from residents). This supports previous research that found that incentive programs motivated homeowners to mitigate wildfire risk, as did agency outreach that took a "carrot" approach as opposed to a "stick" approach (McCaffrey et al., 2011).

Beyond mitigation outreach and strategies, previous studies indicated that risk assessment on private property can be a motivating factor in encouraging residents to mitigate their own properties (e.g., McCaffrey 2004; McCaffrey & Olsen, 2012; Parkinson, Force, & Smith, 2003; Meldrum et al., 2014). In the two previous cases studied, the type and extent of risk assessment varied (Koebele et al., 2014). In both cases, some residents described being fearful that insurance companies would obtain the risk data and use it to increase insurance premiums. Due to this reported fear, some fire agencies were wary of using their limited resources to focus on risk assessment on private property. In Colorado Springs, Colorado, the fire department uses a simple color-coded risk map of parcel-level

data to communicate wildfire risk. Residents reported that this simple color-coded scheme was highly effective in motivating action by residents. Near Fort Collins, Colorado, residents were much more hesitant to participate in risk assessment and fire professionals had to approach the topic more carefully, using a password-protected system through which risk data were available only to property owners and risk assessment was done only by invitation.

Based on these findings, risk assessment approaches were analyzed in the broader survey sample to answer the following question:

RQ2: What approaches are agencies using to assess and communicate wildfire risk to property owners and residents, specifically with regard to agency mandates versus voluntary risk assessment?

When asked, 50% of survey respondents (n=66) indicated that their agency performs wildfire risk assessments on private property. Table 2 uses only this portion of the respondents to further investigate risk assessment methods. A majority of these respondents indicated that they assess property-level risk when asked, but a minority of agencies assesses risk on all properties within their jurisdiction. While this lack of widespread risk assessment likely signals a resource-constraint issue, this finding is noteworthy because face-to-face risk assessment contacts may be a missed opportunity to develop the trust in local government professionals that scholars find is important to encouraging wildfire mitigation (Kent & Gebert, 2003; McCaffrey, 2004). However, it also illustrates the context-sensitivity necessary on the part of fire professionals when designing outreach strategies for the communities in which they work, as some places may be more or less receptive to government involvement in their personal mitigation efforts. While some respondents indicated that they make risk data public, or private through a password system, a majority of respondents did not use either approach. This same pattern is evident in the manner through which risk data are reported; the majority do not report risk data through either a color-coded simple scheme or through statistical data, but use some other means of communicating risk (Table 2).

Unlike in the cases studied previously and described above, fire professionals surveyed for this study indicated that individuals are very receptive to risk

Table 2. Approaches to Risk Assessment on Private Property Used by Fire Management Agencies

	Risk Assessment Method	Total
Approach to risk assessment ⁷ (Check all) (n = 66)	All properties in jurisdiction	38% (25)
	When asked by homeowner	82% (54)
	Publicly available risk data	21% (14)
	Privately available risk data	20% (13%)
	Simple color-coded risk scheme	29% (19)
	Numerical or statistical risk data	21% (14)

assessment on their property (only 6% reported that residents were unreceptive). If residents are perceived as receptive to risk assessment, it may be possible to increase mitigation on private property by informing residents of their wildfire risk through risk assessment approaches. Both fire professionals’ preferred risk assessment approaches, assuming an absence of resource constraints, as well as what they use in practice were analyzed to investigate this disconnect.

RQ2a: Are fire professionals’ preferred approaches different from what is currently being used in practice?

Table 3 shows the rank-order preferences of risk assessment approaches listed by the percentage of survey subjects who ranked the option first. These data include all survey respondents, regardless of whether their agency actually conducts risk assessment. Fire professionals’ most preferred approach for risk assessment was to assess all properties and to make the data public, similar to what the Colorado Springs Fire Department does. This is not, however, what most agencies do, as indicated in Table 2, where only 38% of respondents indicated that their agencies assess risk for all properties within the WUI.

Why then—if these respondents prefer risk assessment on as many parcels as possible, and they think that the public supports it—are they not doing it? The answer to this question likely lies in the limited resources of fire management agencies.

Despite the evidence above that outreach, education, and incentives are more preferred among wildfire professionals, political elites are increasingly calling for more regulatory approaches to wildfire risk reduction in the WUI. For example, in Colorado after the two 2012 catastrophic wildfires studied in our previous case studies, Governor John Hickenlooper appointed the Wildfire Insurance and Forest Health Task Force to assess strategies for coping with wildfire risk (Wildfire Insurance and Forest Health Task Force, 2013). This task force suggested, among other recommendations, that homeowners pay higher fees to build in the WUI. Wildfire professionals and the agencies they work for may increasingly be handed the task of interfacing with residents to implement risk reduction strategies that may include regulations or fees. Therefore, it is relevant to also understand their support for these risk reduction approaches, as analyzed next:

RQ3: Which fire professionals are most likely to support regulatory approaches to wildfire mitigation and risk assessment, and do levels of support reflect personal opinions or professional experience?

Despite the fact that they overwhelmingly rated top-down approaches to encouraging mitigation as less desirable (only 21% ranked them preferred in

Table 3. Ranking of Risk Assessment Strategies

Ranking of Risk Assessment Strategies on Private Property by Percentage Ranking First (n = 82)	
1) Assessment of all properties in WUI—publicly available data (67%)	
2) Assessment of all properties in WUI—privately available data (20%)	
3) Assessment of properties in WUI by invitation—privately available data (10%)	
4) Assessment of properties in WUI by invitation—publicly available data (3%)	

Figure 1), these approaches may be an increasing reality in the American West. To analyze this question, an index variable (GOVREG) was constructed wherein support for regulatory approaches was determined by higher stated preferences on questions focused on government regulation, taxes, and ordinances as preferred methods of reducing wildfire risk. The index had a value range from 0 to 39. Figure 3 shows the plot of the standardized residual for the index variable GOVREG.

In attempting to understand which fire professionals were most likely to support government-mandated regulations as a method of reducing wildfire risk on private property, a linear regression model was constructed to help specify the variables that predict higher levels of support for such regulatory schemes. Table 4 reports the results of this regression. Variables of potential importance based on fire professional demographics may include (i) political affiliation (nominal) or state political context (interval), (ii) the jurisdiction for which an individual works (nominal), or (iii) the conditions of the WUI near them (ordinal). Based on the literature above, (iv) whether fire professionals have experienced positive public

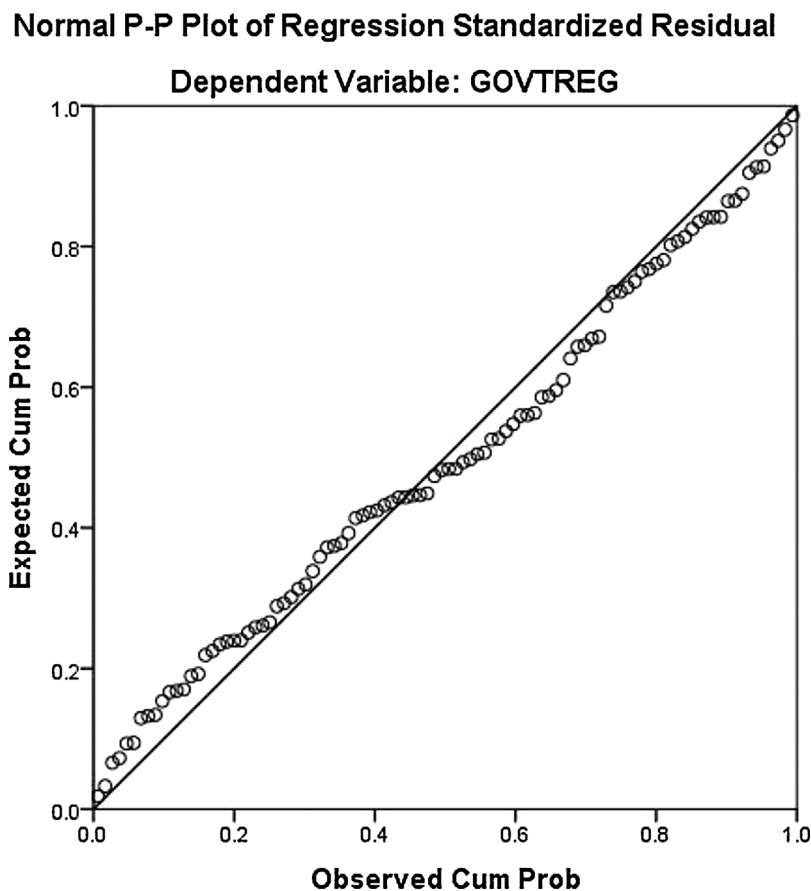


Figure 3. Plot of Standardized Residual for Variable GOVREG.

Table 4. Linear Regression Model for Support of Government Regulation to Reduce Wildfire Risk Through Mitigation on Private Property by Wildfire Professionals in the Western United States

Variable	Regression Coefficient	SE	β	t	df	P (sig.)
Wildfire experience						
Pos. responses to regulations	0.915	0.423	0.268	2.162	4	0.035
Significant growth in nearby WUI	0.405	0.417	0.107	0.972	3	0.335
Opinions						
Climate change is increasing fire risk	0.689	0.502	0.184	1.375	4	0.174
Fire agencies are overburdened	-0.158	0.653	-0.035	-0.242	3	0.809
Risk assessment of all WUI properties best	1.319	0.536	0.285	2.463	3	0.017
Demographics						
State political score ⁸	0.294	0.155	0.211	1.895	9	0.063
Fire agency jurisdiction (fed = 1, local = 5)	0.184	0.290	0.072	0.635	6	0.528
Years worked in wildfire	0.525	0.344	0.176	1.528	5	0.132
Political affiliation (reference: democrat)	-0.139	0.247	-0.063	-0.564	5	0.575

$R^2 = 0.326$. Adj. $R^2 = 0.213$.

reception of regulations for mitigation may be important to understanding their support for regulations (ordinal).

As discussed above, trust between communities and agency personnel is essential to achieving mitigation goals, and “competent” managers earn the respect of their communities (Winter, Vogt, & McCaffrey, 2004). By extension, if fire professionals are cognizant of the beliefs of the community in which they live and work, they may be more likely to support policies that are palatable in that context. (vi) Personal beliefs about the role of climate change (ordinal), (vii) appropriate approaches to risk assessment (ordinal), and (viii) whether growth in the WUI is increasing locally (ordinal) might influence support for more regulatory risk reduction approaches; other research analyzing what motivates environmental action found “concern” to be an important factor in addressing an environmental risk (Wakefield, Elliott, Eyles, & Cole, 2006). Fire professionals’ concern over the possible outcome of a destructive wildfire in their community may contribute to their support of regulatory approaches to mitigation.

The results indicate that neither an individual’s political affiliation nor the state political context within which they work/live are significant predictors of support for regulatory approaches to encouraging wildfire mitigation, although state political context is nearly significant in this model. Individuals who perceive fire agencies as being overburdened are no more likely to support regulatory approaches than their peers,⁶ which is also true for more experienced fire professionals. The variables that do predict support for government-mandated regulations to promote mitigation are (i) support for more active risk assessment in the WUI and (ii) perception of positive responses to regulation among the public. The second finding is particularly important, as fire professionals seem to

strive to work within the constraints of public support, limitations of individual resources, and the realities of fire management agencies. As seen above in preferences of risk assessment strategies (Table 3), fire professionals seem to acknowledge and respect the desires of homeowners when conducting their work. Furthermore, community members also appear to trust local fire agency representatives more so than the institutions for which they work (Kent & Gebert, 2003). Building trust by working within publicly-supported approaches to mitigation may be key to eliciting support for fire professionals and reaching out to the public in effective ways. This also explains the near significant result of the state political context variable in the regression model, but the lack of significance of individual political affiliation of our respondents.

Discussion

This study presents findings focused on the approaches that fire professionals who work for fire response and management agencies in the western United States use to encourage residents to mitigate wildfire risk on private property. The analysis presented here indicates that fire professionals use multiple strategies to encourage and inform residents about mitigation, but they prefer face-to-face contact with residents when possible. Despite the perception that face-to-face contact is highly effective in encouraging wildfire risk mitigation, this approach is not one of the most commonly used approaches. This likely has to do with limited agency resources to devote to the relatively time-intensive process of contacting residents individually.

Fire professionals also indicate a lower preference for government-mandated regulatory approaches for mitigation on private property. Those professionals who do prefer these regulatory approaches are those who also support more aggressive and comprehensive risk assessment on private property in the WUI and those who perceive positive response from residents related to regulatory approaches to mitigation. This indicates that fire professionals are aware of, and interested in, the political or social feasibility of the approaches that they use to increase mitigation by residents. This is also supported by the findings presented above related to risk assessment on private property. Survey respondents preferred rating all properties in their jurisdictions and making the data publicly available, but they indicated that when invited to assess risk by a homeowner, these data should be kept private. Fire professionals seem keenly aware of limitations posed by residents' preferences, perceptions, and support for various mitigation and risk assessment approaches.

As such, fire professionals may be well-served to capitalize on approaches that build on the effectiveness of face-to-face contact, but also take into account the limited resources with which agencies must cope, such as the citizen-to-citizen networks used by the Colorado Springs Fire Department (Koebele et al., in press). For instance, only 38% of fire professionals report using citizen-to-citizen networks often, but citizens in our prior case studies report that these are highly effective in encouraging wildfire risk mitigation because they entail aspects of personal contact. Other research has emphasized the importance of establishing

and nurturing these networks in different contexts (Fischer, Kline, Ager, Charnley, & Olson, 2014) so it is important to highlight this disparity between agency practice and effectiveness. Additionally, collaborating with NGOs, local governments, and media may be more effective strategies than disseminating passive literature or holding public meetings or community events, which are perceived as less effective and less used by residents.

Conclusion

Understanding the many approaches to promoting mitigation on private property and their level of effectiveness is increasingly important as wildfire becomes an ever-more present risk in the growing WUI of the American West. The findings from this study indicate that fire professionals use a suite of methods ranging from passive to active dissemination of information as well as regulatory approaches and incentives for promoting mitigation. The findings also indicate that fire professionals may select mitigation outreach and incentive approaches based, at least in part, on how well-received they think an approach will be by property owners. These well-received approaches may provide bridges for building trust between agency personnel and residents, simultaneously increasing the likelihood of overcoming barriers to collective action within the WUI.

Building on the findings presented here, future studies should include larger samples from each western state to enable analysis of state-level preferences and differences in mitigation practices. Additionally, since this study increases general understanding of fire professionals' perceptions of residents' receptivity to mitigation outreach, it would next be useful to study residents' perceptions of those strategies and their use of various mitigation tools and sources of information. Also, because this study begins to explore the role of mitigation incentives versus mandates to overcome collective action barriers, future work can expand this type of analysis in other topical areas such as flood insurance, coastal climate threats, and water rationing during drought, to name a few. Finally, because several outreach approaches deemed effective by wildfire professionals were used infrequently, presumably due to resource constraints within agencies, it will be useful for scholars to attempt to understand the following resource constraint puzzle: are these strategies cost-effective, despite higher real costs? If there is enough risk reduction realized as a result of using these strategies, perhaps they are worth the extra cost incurred by agencies. Learning how wildfire management agencies and professionals can work within the challenges (collective action and jurisdictional, in particular) and constraints (resource limitations and lack of public acceptance of regulatory approaches, for example) they are faced with to help residents reduce wildfire risk is an increasingly urgent area of inquiry and one that this study contributes to. Further research in this field is still needed and will help managers and scholars understand how fire professionals can best use limited resources to increase risk mitigation behavior by residents in the WUI.

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Notes

1. We use the term “wildfire professionals” or “fire professionals” rather than “public lands managers,” “fire managers,” or variants thereof, to capture the multi-jurisdictional nature of wildfire risk communication and mitigation. We define a “wildfire professional” as any public official that works in wildfire risk communication, mitigation, or response, plus any member of a non-governmental organization that focuses primarily on wildfire.
2. Any organization implementing regulations or requirements can levy sanctions, but the source of power (i.e., the government vs. a homeowner’s association or an insurance company), as well as the cost to the residents, can vary.
3. A fire was determined to be significant if a Type I or Type II fire incident response team was deployed to the fire response.
4. Firefighters have an average age of 39.4, while forest management professionals are 39.1. There are no statistics kept on wildfire professionals, so it is important to keep in mind that our descriptive statistics are compared loosely to these two fields.
5. For example, in Colorado as of October 2014, 31% of registered active voters were registered as Democrats, while 32% were registered as Republicans.
6. This finding may be related to lack of variance on this measure since most fire professionals believe that agencies are overburdened.
7. Other approaches offered by respondents included direct contact with homeowners to provide informal or formal risks assessments, often using a narrative description of the property’s wildfire risk rather than a formal analysis.
8. The State Political Score is a score derived from the party holding the following offices in each state: Governor, State House, State Senate, U.S. Senate (2), % U.S. House of Representatives. Scores range from 0 (Idaho, Utah, Wyoming) to 9 (Oregon). The score is calculated based on whether Democrats hold each office, assuming that Democrats would be positively correlated with higher support for government regulations (dependent variable).

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