

Wildfire evacuation and its alternatives: perspectives from four United States' communities

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Abstract. Recent years have seen growing interest within the United States fire management community in exploring alternatives to the standard approach of evacuating entire populations that are threatened by a wildfire. There has been particular interest in what can be learned from the Australian approach, whereby residents choose whether or not to evacuate under the 'prepare, stay and defend or leave early' approach, also called Stay or Go. Given these developments, it is useful to understand what elements are taken into consideration by those who would be most affected by a new approach when they think through the pros and cons of mass evacuation *v.* an alternative strategy should a wildfire occur. This paper reports on findings from interviews in four communities in the United States where some alternative to mass evacuation during a wildfire was being considered. In each community, emergency responders and community members were asked for their perspective on the pros and cons of evacuation and the alternative being considered. The results show that opinions were mixed on whether evacuation or an alternative approach was more appropriate. Individuals who were primarily thinking of improving safety and reducing uncertainty for emergency responders tended to think mass evacuation was the best approach, whereas those who were primarily thinking of increasing safety and reducing uncertainty for homeowners were more likely to think that alternative responses were a valid option. These findings demonstrate the complicated nature of developing evacuation strategies that are beneficial to all parties involved.

Received 28 March 2013, accepted 15 December 2013, published online xx xxxxx xxxx

Introduction

Recent years have seen a growing discussion in the fire management and academic communities about how to best manage populations who are threatened by a wildfire. In the United States (US), the accepted practice has been to evacuate all members of the public who are threatened by a wildfire. Under this approach, fire and law enforcement personnel work together to determine the degree of the threat and areas to which voluntary or mandatory evacuation orders need to be applied. Once an area is under a mandatory evacuation order it is expected that all non-emergency personnel will leave the area and access is restricted (Bonkiewicz and Ruback 2012).

Although mass evacuation has generally been considered functional in the US, questions have begun to be raised as to whether this is always the most appropriate response for wildfires and whether there are viable alternatives. One reason for considering alternatives is recognition that in some places evacuations may not be feasible, particularly where limited access points and likelihood of fast-moving wildfires may result in insufficient time to leave (Cova *et al.* 2009). In addition, even when there may be sufficient time to evacuate, evidence suggests that many wait to the last minute to leave which can put

lives at risk. Work in both Australia and the US has demonstrated the dangers posed by such late evacuation. Mutch *et al.* (2011) provides several examples of incidents in which people died in the US (and other countries) while trying to evacuate. In a review of Australian bushfire fatalities from 1900–2008, Haynes *et al.* (2010) found that 176 of the 552 deaths (32%) occurred during late evacuations. By contrast, just 8% of deaths occurred while people were sheltering within a defensible property.

Another concern with mass evacuation is due to growing evidence that many homeowners do not intend to automatically evacuate for wildfire (Cohn *et al.* 2006; Mozumder *et al.* 2008; Paveglio *et al.* 2010b; McCaffrey and Winter 2011; Stidham *et al.* 2011). For example, in a 2009 survey of residents in California, Florida and Montana, 11% of respondents indicated that they intended to stay throughout the fire and around half of participants intended to leave only when the threat was imminent (McCaffrey and Winter 2011). Qualitative wildfire studies have found that the stress of being away from home, uncertainty of when they could return, lack of information on status of homes, general lack of control and duration of the evacuation order contributed to some residents' intentions to stay at home

during a fire (Cohn *et al.* 2006; Stidham *et al.* 2011). Desire to protect their home is another reason that residents may intend to stay at home during a wildfire (Cohn *et al.* 2006; Paveglio *et al.* 2010b; Mutch *et al.* 2011). Finally, as post-fire examinations have revealed that significant home loss is caused by embers that can land before or after the actual flame front passes through (Cohen 2000; Quarles *et al.* 2010), some argue that as firefighters will not be able to protect every home, having trained homeowners who are willing and able to remain on well-prepared properties to extinguish embers and spot fires can significantly reduce damages incurred during a wildfire (Stephens *et al.* 2009).

This combination of safety concerns, variable resident compliance with evacuation orders, potential to protect property from embers and rising demands on firefighting resources has caused some academics and fire professionals to look at concepts of shelter-in-place and the Australian policy of 'Stay or Go' (formally referred to as 'Prepare, Stay and Defend or Leave Early') to determine their applicability in the US (Cova *et al.* 2009; McCaffrey and Rhodes 2009; Stephens *et al.* 2009; Paveglio *et al.* 2010a; Mutch *et al.* 2011). The Australian approach evolved over many years and encouraged residents to consider in advance what action they would take during a wildfire. If a wildfire threatens they are expected to either leave well before the wildfire or stay and actively defend their property from ember ignitions. During the actual passage of the flame front they would shelter in their homes or another designated structure. With either choice residents are expected to prepare their properties to be defensible in the event of a wildfire (Handmer and Tibbitts 2005; Rhodes 2012; Whittaker *et al.* 2013).

Early in 2009, an outbreak of extreme fires in Victoria, Australia, commonly referred to as the Black Saturday fires, resulted in 173 civilian deaths, triggering a critical review of the Stay or Go approach by a government commission. After a comprehensive review of events and preparedness and response actions, the Victorian Bushfires Royal Commission (VBRC) found that the central tenets of Stay and Go were sound, but that implementation was lacking and the approach was not necessarily applicable in all fire conditions (Teague *et al.* 2010). The Commission's recommendations led to a revised approach, termed 'Prepare. Act. Survive.' (PAS) that emphasises the danger of both leaving late and staying, and the need for improved warnings and additional shelter options. In addition, greater emphasis is placed on helping citizens to prepare for fire, both physically and mentally (Teague *et al.* 2010; Paveglio *et al.* 2012; Rhodes 2012). In assessing the policy shifts on a risk responsibility continuum, with self-reliance at one end and central authority at the other, McLennan and Handmer (2012) found that both Stay or Go and PAS focussed on the notion of shared responsibility, but with different framings the former was situated towards the self-reliance end of the continuum whereas the latter has shifted the overall approach towards the central authority end, in the process creating a greater sense of collective action throughout the community.

Despite multiple papers that consider the applicability of evacuation alternatives in the US (see e.g. Paveglio *et al.* 2008; Cova *et al.* 2009; Gill and Stephens 2009; McCaffrey

and Rhodes 2009; Stephens *et al.* 2009; Mutch *et al.* 2011), only two studies have empirically examined communities in the US that have actually implemented an alternative. In Wilderness Ranch, Idaho, recognition of local evacuation issues and firefighting limitations, coupled with a local culture of self-reliance and dislike of being told what to do, contributed to development of a Stay or Go type alternative where residents and local firefighters supported the notion that those with well prepared properties could viably stay (Paveglio *et al.* 2010b).

In Rancho Santa Fe, California, five neighbourhood developments were built with building codes and landscape standards designed to withstand a wildfire, allowing residents to remain in their homes during an evacuation order if they choose. Known as shelter-in-place (SIP), this model is a more passive response than Stay or Go, residents are not expected to actively extinguish embers but to simply shelter in a safe structure as the fire passes (Paveglio *et al.* 2010a). In 2007 interviews, Paveglio *et al.* (2010a) found limited awareness of the policy among residents with a majority unclear what they were actually supposed to do during a wildfire. Nor were fire officials found to be clear about the policy: some considered it a useful alternative to utilise if needed, whereas others saw the policy as more about pre-fire mitigation actions involving construction practices and vegetation mitigation. The interviews were conducted before the 2007 Witch fire, which burned through some of the SIP developments that were evacuated, although some residents opted to stay in their homes (Paveglio *et al.* 2010a; Mutch *et al.* 2011). That the SIP developments were under official evacuation order just like the rest of the community corresponds with one of the policy options suggested by Cova *et al.* (2009) where the alternative serves as a back-up plan when safe evacuation is not feasible.

More empirical work has been conducted in relation to public response during a fire in Australia. Research both before and following the Black Saturday fires highlights the diversity of ways people respond to a fire and the complex array of factors that influence decisions on what they are likely to do (see e.g. Tibbitts and Whittaker 2007; Eriksen and Gill 2010; McLennan *et al.* 2012; Whittaker *et al.* 2013). Evidence from the VBRC and subsequent research (Whittaker *et al.* 2013) showed that of those who evacuated on Black Saturday, over half left late and many were not adequately prepared to deal with such extreme fire conditions. A review of the circumstances of fatalities in the fires found that people's response often failed to take into account the risks of their particular situation and the fire threat (Handmer *et al.* 2010). Far from showing either a consistent picture of public response or of changed behaviour since Black Saturday, as a group the studies highlight the complexities of response and routinely call for more research.

Overall, the research suggests there are potential problems with evacuations in certain circumstances, that alternative responses are under consideration in some US communities, that a critical review of the Stay or Go approach in Australia has led to some changes but the central tenets of the policy have remained and that a series of complex factors contribute to individual responses to fire, regardless of community approach. However, empirical findings are limited, particularly in the US,

and there is a clear need for more research to understand how those who must directly deal with an approaching wildfire, both emergency responders and homeowners, think about the various approaches. In particular, only two studies to date (Paveglio *et al.* 2010a, 2010b) have collected data on the views of emergency responders in the US regarding evacuation and potential alternatives. The current paper seeks to build on this knowledge base by examining what factors emergency responders and, to a lesser degree homeowners, in the US consider when they contemplate the appropriate response to wildfire within their communities.

Methodology

This exploratory study utilised a qualitative approach to examine what shapes consideration of an alternative to mass evacuation in US communities at risk from wildfire. Given that mass evacuation is the accepted approach in the US, consideration of alternatives is not necessarily something many individuals have thought about. As we were interested in understanding the viewpoints of those who were considering something other than mass evacuation, we worked to identify communities where there was some evidence that evacuation alternatives were a point of discussion. In order to find such communities we conducted internet searches for news articles, web pages and policy documents discussing evacuation alternatives. After identifying potential communities, fire managers in each community were contacted to learn more about community actions towards developing evacuation alternatives. Through this process four US sites were selected that had taken some concrete step (e.g. production of brochures with specific information related to not evacuating, presentations to community members, training efforts) towards an evacuation alternative: Painted Rocks, Montana; Ventura County, California; Santa Barbara County, California and Santa Fe, New Mexico. In each case, the new approach was being supported by the fire department with primary responsibility for the area in which the alternatives were being discussed. Although this meant the geographic scale being discussed varied greatly (from city to county to a valley) the role of the fire organisation was a consistent element across sites.

To gain a broad understanding of the perspectives on the issue at hand, research participants were purposively selected (Babbie 2001). This ensured that everyone we interviewed had already thought at some level about both evacuation and the alternative being proposed in their community; our questions were not their first introduction to the topic. In each community we identified primary representatives from the emergency response organisations who would be most affected by implementation of an alternative (primarily fire and law enforcement personnel within local, state or federal agencies). In order to get a broader understanding from both those calling for the revised approach and those that have to abide by it, we were also interested in gaining local residents' perspectives. Therefore, at the end of each interview with agency personnel we asked for a recommendation of residents who lived in areas of greatest

wildfire concern and who were at least somewhat familiar with the alternative being considered. As an exploratory study, our sample of residents was limited and intended only to get a sense for how residents might be responding to the new approaches. In total, 32 interviews were conducted: 15 with agency representatives (fire personnel, public information officers, office of emergency services and law enforcement), 12 with residents (including one extended group interview of five people^A) and five with members of the Painted Rocks Fire District, which, being a volunteer fire department made up of local residents, meant they tended to provide both perspectives in their interview.

Data were collected in June 2008, through semi-structured interviews (Rubin and Rubin 2005). Interviewees in each group were asked about the alternative approach being considered and reasons for considering it, factors they contemplated in determining the most appropriate response to wildfire for their community and what they perceived as the pros and cons of the existing approach versus the alternative. Interviews were conducted in person and lasted ~1 h. All but two interviews were recorded and transcribed; detailed notes were taken during the interviews where the participants requested they not be recorded (Kvale 1996).

Data were analysed using standard qualitative processes (see e.g. Miles and Huberman 1994; Strauss and Corbin 1998). Transcripts (or notes) were first read through to identify broad topic areas. Transcripts were then read through again and passages pertaining to one of the broad topic areas were coded with the aid of NVivo, a qualitative analysis software program (QSR International, Version 7). Once each transcript was coded using the broad topic areas, code summaries were developed that contained all passages that had been identified as a particular code (Rubin and Rubin 2005). Two researchers separately identified specific themes within each code summary and noted when a theme was mentioned more or less frequently in a specific site or stakeholder group (agency personnel and residents). These themes were then compared between researchers to verify consistency of findings.

Finally, because the data were collected before the Black Saturday fires in Australia, we subsequently contacted several interviewees to assess whether the fires had influenced the alternative approach within their community. How the actions we discussed in 2008 have or have not changed will be addressed in the discussion section.

Results

Given the small overall sample, discussion of themes identified in the interviews generally refers to the entire pool of interviews; notably, most themes were heard across groups and sites. When certain views were more commonly expressed by a particular group (either residents or agency personnel) or at a particular site it is noted. Interviews identified the key contextual variables shaping the evacuation alternative discussion in each site and the alternative approach that was being discussed in 2008.

^AA couple that had been scheduled for an interview asked several neighbours to participate. The same questions were asked of this group and the interview concomitantly was longer.

Painted Rocks, Montana

Painted Rocks is a remote community of residences that are dispersed along a valley in south-west Montana. The permanent resident community in the area is made up of both long-term and more recent arrivals who were often from professional backgrounds. There are also significant numbers of part-time residents. In 2000, numerous wildfires threatened the community and led to evacuations that generated significant community angst around the uncertainties of evacuation and difficulties obtaining information. During the fires members of the community had exposure to the Australian Stay or Go model from Australian firefighters who were working on the fires; in 2006, a variation of the model was formally adopted by the Painted Rocks Fire District as an alternative to evacuation. The approach acknowledges residents may choose to leave early, but also supports residents choosing to stay to defend their property provided they have undertaken appropriate preparation. Coordinated efforts were being made to create defensible space on all properties within the district and to train residents on what they should do if they stay during a wildfire.

Ventura County, California

Ventura County in south-central California contains large, diverse populations of people living in urban areas, incorporated cities and towns, wildland–urban interface (WUI) areas and dispersed rural houses. The county has areas of extreme fire risk and a history of significant fires in recent years that affected communities. The county fire department is the primary fire department for the entire county including most of the incorporated cities. Over the previous several years, the fire department had begun to actively promote an alternative to evacuation. Although evacuation remained the recommended approach, residents were seen not as something to be managed but as a potential part of the solution who could potentially assist fire services during a wildfire event. Residents were encouraged to prepare their property and information was openly provided on how to stay safely, whether by choice or inability to leave. Ventura County outreach materials and fire personnel, while indicating a preference for evacuation, allowed room for homeowners to choose to stay and defend.

Santa Barbara County, California

Located directly north of Ventura County, Santa Barbara County faced similar fire challenges as Ventura, albeit with a larger proportion of dense communities with limited evacuation routes. Santa Barbara County, which also had a county-wide fire department with similar fire responsibilities as Ventura, had only recently adopted aspects of the Ventura County approach when data were collected. Although information about how to stay safely was included a brochure, the county had far less explicit support for the alternative of staying. Both the written material and fire personnel interviewed in Santa Barbara emphasised that evacuation was the strongly preferred option.

Santa Fe, New Mexico

The City of Santa Fe in New Mexico has several neighbourhoods with significant fire exposure and limited access roads. These areas have a diverse population of permanent and

part-time residents. After the Cerro Grande fire of 2000, the city fire department initiated an effort to build its wildland fire capacity. Resultant discussions within the department highlighted the potential evacuation issues in several at-risk areas, which led to discussion of the possibilities of sheltering in place. Local county and federal fire officials showed little interest in the idea so discussion remained limited, primarily at the city level. At the time of the study the primary product was a brochure that included basic information about how to safely stay at home during a wildfire.

Benefits of evacuation

Across all sites and within both stakeholder groups the dominant argument for evacuation was life safety; it was seen as the surest way to protect life and eliminate the risk to as many people as possible. This discussion had several subtexts. The first might be called ‘better safe than sorry’ with several interviewees stating that evacuation might not always be necessary, but given the uncertainty around fire behaviour it was better to err on the side of having people leave.

Well you know when you get out of harm’s way, you’re ... out of harm’s way and so the risk has been mitigated. [Santa Fe Agency Personnel B]

Several agency personnel also indicated that evacuation was safer in terms of liability; that any sort of indication that it was okay to stay could lead to lawsuits if someone then stayed and died. Only a few people raised the inverse liability possibility, that of telling people to evacuate and then having someone die while evacuating. Two individuals also mentioned that the potential health impact from smoke was another reason it was safer to have everyone leave.

A second benefit of evacuation was consistently raised by agency personnel, but not residents, primarily in Santa Fe and the California sites: removing the public from the fire area eliminated several potential points of uncertainty that were seen as creating an additional burden on fire and law enforcement personnel. There were four arguments for why it was simpler to have people leave: (1) concern that individuals who stayed might panic and change their minds and then need to be rescued, thereby putting emergency personnel lives at risk; (2) questions of whether those who stayed were sufficiently well informed and prepared; (3) a belief that people who stayed would get in the way of emergency responders and (4) a belief that emergency responders would need to keep track of who had stayed and who had not.

It creates a ... additional burden from the fire management point of view and from the sheriff’s point of view that you do have civilians in there ... If they do have a burn over you’ve got to go rescue them, you’ve got to bring these people out. And you’ve got the medical aids, people falling off the roofs... [Santa Barbara Agency Personnel D]

Concerns about evacuation

The most commonly mentioned concern about evacuation was the danger of late evacuation.

...they’re preparing to evacuate, it’s their intention to evacuate and something happens, they get a flat tyre or the

car won't start or they can't find the dog or whatever. And all of a sudden they can't. Then they need to be prepared to stay. And I think that should be the message to anybody who lives out there, anything could happen, a tree could come down across the road and you'd have to turn around and go back. [Santa Barbara Agency Personnel B]

In both Santa Barbara and Santa Fe participants specifically noted how poor road infrastructure (twisty and narrow roads and limited egress for numerous houses), combined with the local tendency towards fast moving fires, meant there was a good chance people might not have time to safely evacuate.

... seeing people getting killed in California and elsewhere trying to evacuate. That's where the deaths were occurring and that was really concerning to us. In some of the areas of east and north Santa Fe we could have some of those same evacuation problems, and maybe it makes more sense to start looking at providing some information on shelter-in-place, educating ourselves on what that concept entails and what we could do about it. [Santa Fe Agency Personnel B]

A second set of concerns revolved around the potential logistical costs of evacuation: unnecessary evacuations, the length of time people were kept out and the inflexibility of the evacuation process. Although many agency personnel felt that evacuation was a simpler choice overall, comments from several agency personnel and residents highlighted that in reality doing evacuation right is not simple: a smooth evacuation requires planning to ensure that people are not evacuated unnecessarily or kept out longer than needed as such actions could have significant economic and emotional costs. Several interviewees commented that it was not uncommon to evacuate areas larger than needed or for longer than needed simply for convenience of the fire and law enforcement personnel and that this could lead to public anger with the agencies and potential issues in future evacuations.

These logistical costs of evacuation were most commonly raised in Ventura County and Painted Rocks where the road infrastructure and likely fire behaviour meant there were fewer concerns that poor road access would be an issue that could lead to individuals not being able to evacuate safely. In Painted Rocks, the costs discussed were both economic and personal. Several participants mentioned that one local guest ranch was estimated to have lost tens of thousands of dollars a day during a previous fire. From a personal standpoint, residents expressed frustration with the rigidity of the evacuation process that meant that once they left the evacuation zone they could not return even if the fire was not immediately threatening their property, or if they only wanted to leave temporarily in order to assist vulnerable household members in moving to a safer location. Painted Rocks residents also discussed the emotional costs of evacuation, particularly the stress of being kept out of their property for an extended period with little information about what was happening. Residents stated that they understood their responsibilities living in high wildfire risk areas, but were often frustrated by agencies that failed to acknowledge residents' rights and desire to decide what they would do. At the very least they wanted to have access to information so they understood what was happening and why they could not return to their property.

Benefits of alternative approaches

These evacuation concerns were the primary rationale for developing alternative approaches in each of the communities. The benefits of broadening resident options beyond mass evacuation focussed on two topics: improved resident safety through information provision and logistical advantages.

For many respondents, particularly agency personnel, a benefit of the alternative approach was that it made it easier to openly provide information to residents about actions to take to improve their safety if they could not (or would not) evacuate. For some, primarily agency personnel in Santa Barbara and Santa Fe, provision of this type of information was 'the lesser of two evils': although concerned that providing information might appear to be giving permission to ignore evacuation orders, ultimately they felt there was a moral obligation to provide residents with information about what to do if they couldn't evacuate.

If you look at our mission, our mission is to protect lives, property and the environment. To not give them this kind of information, to me, is negligent and contrary to that mission. [Santa Barbara Agency Personnel A]

It's a ... a Catch 22, if you don't do appropriate public education with it, that somebody could either stay in harm's way too long or possibly get caught in a bad situation when they're leaving. [Ventura Agency Personnel D]

Similarly, agency personnel who recognised that some people choose to stay during a mandatory evacuation order felt there was a moral need to make sure these individuals understood what was required to stay as safely as possible.

And they said we're not leaving, so okay. So let's give them a better option, let's give the person who would refuse to leave anyway the tools to be safer. You know if the guy's going to put himself in a high-risk environment, let's lower the risk. [Painted Rocks Fire District Personnel A]

... because some people are going to stay anyway, but at least if you give them both sides of the story you allow them to make an educated decision. [Santa Fe Agency Personnel A]

For another segment of the interviewees, providing information was seen less as an act of moral need for those who could not or would not evacuate, but more an act of empowerment: helping people understand the full spectrum of issues so they could make an informed choice for their particular situation. They stated that it could be hard for government agencies, firefighters in particular, to acknowledge their limits and admit they could not protect all homes, but that it was important to treat people like adults and provide them with information to make the best choices in different situations.

It gives people the tools ... it empowers them. That's the change right there. That's the expectation of what we want to see, is that the public is making the right choices in certain ... scenarios. [Ventura Agency Personnel C]

I think we're coming to a point where there ..., it's not one or the other ... I think it's up to the homeowner to decide, you know I think we need to give the homeowner the tools to decide what's best ..., in their best interests. [Santa Fe Agency Personnel A]

Alternative approaches were seen to have benefits beyond improving the safety of those who did not evacuate. Several individuals discussed the benefits of not evacuating in terms of how it eliminated potential logistical costs of evacuation – as one research participant put it, it allowed for the ‘freedom and security of being in one’s own home’. In Painted Rocks where homeowners had previous experience with evacuation, participants felt the ability to remain in one’s home could provide a greater sense of control, which they thought would reduce the uncertainty and helplessness associated with evacuation. For one couple in Painted Rocks who had initially stayed during a fire in 2000, but then evacuated, the uncertainty of not knowing what was going on while out of the area was more stressful than that of staying in place. They were very clear that should there be another fire they saw staying as the less stressful option and were preparing their property accordingly.

A: But it was worse to evacuate.

B: It was.

A: Because we had no idea what was going to ... it was very stressful because we didn’t really know anyone here yet and we couldn’t get any information from the Forest Service because the personnel changed every couple of days. [Painted Rocks Residents A&B]

Potential firefighting resource limitations were another reason for considering an alternative option to evacuation. In all locations there were interviewees who felt it was likely that fire agencies would not have enough resources to protect all houses during a large wildfire; as a result it might be necessary for homeowners to be self-sufficient and able to protect their property themselves. For some interviewees, homeowners preparing their properties and possibly remaining was seen as a means of increasing the resource base – not in terms of fighting the fire, but in terms of house protection. This view was most dominant in Painted Rocks where several interviewees felt that homeowner involvement would not only increase the number of options available, but also increase firefighter safety as they would be working in a safer environment.

...with residents, you know, those are resources that they know their household, their home areas better than anybody else and if we can prepare the home so it’s a safer ground for them to do their thing, great, let’s use them. It, what, quadruples our fire fighting capability. [Painted Rocks Fire District Personnel C]

In both California sites, resource limitations appeared to be less of a driving factor in considering alternatives. Although some agency personnel did mention it as a consideration, others argued that the area was quite well resourced and it was not an important reason for considering an evacuation alternative.

More openly recognising that residents might choose or need to stay was also seen by some as providing an additional incentive for homeowners to prepare their property beforehand. For several agency personnel this last argument was the primary benefit to considering options beyond mass evacuation.

If I had to prepare my house knowing I was going to stay there, I would do a super job of preparing that property. [Painted Rocks Fire District Personnel B]

I don’t see it as a bad thing, I think it’s a good thing. I mean it might, ... if people took all the appropriate measures around their house we might mitigate against the need for evacuation in the first place. [Santa Fe Agency Personnel E]

For a subset of respondents, primarily individuals in Painted Rocks, the notion of an alternative approach included preparing properties beforehand, but went further to include homeowners taking full responsibility for choosing to live in a fire risk area and protecting their home themselves rather than letting firefighters put their lives at risk.

Concerns with alternative approaches

Several participants expressed concerns about the alternative, or raised issues that needed to be addressed if the approach was to be successful in their communities. These concerns tended to be raised primarily from an agency perspective in relation to managing the unknowns of a new approach. Although evacuation had risks, they were at least known, whereas adopting an alternative was full of unknown risks. People who stayed still might die even if they followed instructions, or people might not follow instructions and make poor choices, leading to injury or the need to be rescued. Some agency personnel also expressed concern that providing information on how to stay safely might encourage everyone to stay.

We’ve been struggling with it because the last thing that we want to do is encourage people or let them think that sheltering in place is a good alternative to evacuation and then heaven forbid something happened, their house burned while they’re in it or they get trapped and die based on ... recommendations that we made about shelter in place. I think that’s been our biggest struggle. [Santa Fe Agency Personnel A]

However, residents consistently had more faith in the ability of community members to understand the full nuance of information and were less concerned that the additional information would be misinterpreted or misapplied. Rather, they saw withholding information on how to stay as safely as possible as paternalistic and not in the interest of the agencies and the public. They also felt that the more people understood the challenges of staying the less likely they would be to stay.

And I think a lot of it was liability issues. They didn’t want to recommend sheltering in place because then if the thing didn’t work, the lawsuits would be flying. So I mean you understand why. But I think in this County people are savvy enough to know that’s not what they’re telling us, they’re not saying stay at all costs. They’re basically saying you have to decide if you want to stay, don’t stay if you’ve got a wood frame house and surrounded by pine trees. [Santa Barbara Resident C]

Some residents clearly wanted to make their own decisions, particularly in Painted Rocks where participants referred to the independent character of the local culture. Residents in all areas referred positively to agencies providing them with additional information so they had a more realistic understanding of wildfire and their options.

Even those most comfortable with residents staying and defending their properties recognised that implementation

required a great deal of work from a variety of angles including education, training, communication and coordination across all parties involved, including both homeowners and agencies.

I think it's a lot of work, it's a lot of work engaging the community and you know, putting these things on and I think that's the only disadvantage right now. [Painted Rocks Fire District Personnel D]

Discussion

The findings of this study demonstrate the complexity of developing evacuation alternatives that meet the expectations and needs of all parties involved. Using McLennan and Handmer's (2012) risk responsibility continuum it could be argued that the traditional mass evacuation approach of the US has been situated towards the central authority end of the continuum. In each of our four locations a series of factors led to a shift away from the traditional model including: recognition of the limitations of evacuations and firefighting resources, acknowledgement of the range of public response during wildfires and realisation of the public's need for more detailed information so they could be prepared for all possible scenarios during a wildfire. In response to these shifts our four communities had developed one of three general versions of an alternative that could be placed on the continuum: Santa Fe and Santa Barbara appeared to have taken only a small step away from the central authority approach. In these communities the focus was still on fire agencies being responsible for evacuation decisions and the option of staying with the property was seen as a 'fall back' position if residents were unable to leave in an agency-directed evacuation. The emphasis remained on residents leaving when told, while recognising that evacuation may not always be possible and therefore residents also need to know how to survive if unable to leave. Ventura took this one step further towards the self-reliance end: evacuation remained the recommended approach but residents were not seen as something to be managed but as a potential partner in improving wildfire outcomes. The Montana approach represents a full shift to the self-reliance end of the continuum where homeowners were given full choice of whether to leave or stay and defend their properties and significant efforts were being made to ensure those who planned to stay were prepared to do so.

The approach in each community appears to reflect the attempt to balance two key variables, increasing safety and reducing uncertainty; however, the means of addressing the variables varied depending on whether the focus was on emergency responders versus on residents. When the priority was on improving safety for emergency responders, mass evacuation tended to be seen as the best alternative. When the priority was on increasing safety for residents, providing adequate information and support to enable residents to safely stay, whether they were trapped or chose to stay, was seen as the preferred option. Agency participant views varied across the spectrum depending on whether they placed greater emphasis on the emergency responders' safety or if they focussed more on the fact that evacuations did not always produce the best outcomes for residents. In contrast, although each resident differed on their view of what the safest action was for their individual situation

(evacuating or staying), they were all clear that the traditional desire of fire and law enforcement agencies to control information and evacuation decisions for them was not desirable or necessarily always improved their safety.

Underlying the safety discussion were different notions of who was primarily responsible for public safety. Those who tended to focus responsibility on agencies tended to see provision of information to the public about staying as a moral necessity – given agency assumption of responsibility for public safety they had a moral obligation to provide information to homeowners if circumstances forced homeowners to look after themselves. Those who saw public safety as more of a shared responsibility between agencies and homeowners tended to discuss sharing information in terms of empowerment, helping homeowners take more responsibility for their interests and potentially, as in Montana, helping agencies with protecting properties during an event. Of the residents we spoke with, none objected to the notion that a resident might choose to stay and protect their property or to provision of information about the option. It was seen as their choice, one that few people were likely to take if they fully understood what it entailed. For some residents, staying and protecting their property was not only seen as their choice, but their responsibility given it was their decision to live in a high fire risk area.

How to best reduce uncertainty during a wildfire was the other factor shaping preferences for an approach. For many agency personnel reduction of uncertainty was best accomplished by evacuation; removing residents from the area decreased uncertainty by reducing the number of variables they needed to consider while fighting the fire. For residents, reduction of uncertainty was accomplished by provision of information: before a fire of what to do if they couldn't evacuate and during a fire of what was happening. For some, especially those in Montana, reducing uncertainty was best accomplished by empowering residents to stay with their property during a fire. Although our sample of residents was small, concerns about lack of information and the stress and uncertainty of evacuation parallel resident views found in other studies (e.g. Cohn *et al.* 2006; Stidham *et al.* 2011) suggesting the views we heard are not atypical.

As our interviews were conducted in 2008, we subsequently contacted a subset of interviewees in each location to determine if the events of the 2009 Black Saturday fires resulted in a re-evaluation of their views or the approaches being developed in the four communities. We found little change in their views or the approaches: three of the communities are essentially pursuing the same approach as described in 2008 whereas one area has modified its approach slightly. Similar to the conclusions of the VBRC, Painted Rocks determined that the basic tenets of the Stay or Go policy it had adopted remained viable, but that additional warning procedures needed to be added to alert residents to extreme conditions that would necessitate evacuation even of well prepared properties (Mutch *et al.* 2011). The other three communities have adopted the Ready, Set, Go program, a national program (developed in part by Ventura County personnel) initiated in 2010. This program is closely aligned with the approaches we found in Santa Barbara and Santa Fe where information is provided on how to stay safely if 'trapped' but with a clear recommendation to evacuate

if possible. Ventura County thus took a small step back from its original approach; in part to have a congruent message with its surrounding counties (including Santa Barbara) and in part due to the Black Saturday fires.

The approaches adopted by the communities we studied continue to reflect the tensions between how to best reduce uncertainty and how to increase safety for both fire personnel and residents, and highlights the challenges facing agencies and communities who are threatened by wildfires. Ultimately, in Painted Rocks, as a fire department composed of residents who were volunteers there was greater congruence between the needs of emergency responders and residents which likely facilitated full adoption of the Stay or Go model. In the other three locations there was a more distinct separation of fire personnel and residents, perhaps leading to the tendency for more incremental modification of the existing system as a more known or certain option.

Although this study was small in terms of communities and interviewees, the purpose was to explore the perspectives of agency personnel and residents who were involved to varying degrees in developing alternative approaches to mass evacuation. Although our conclusions are therefore not representative of the general population, we believe they provide valuable insight into the dynamics that underpin the thinking and actions of agency personnel and residents about community response. As such we believe it can inform further research on how agencies and communities respond to the wildfire threat.

The growing interface between homes and wildland fires is not unique to the US or Australia but is a growing issue throughout the world with home loss and civilian deaths in areas as diverse as Mexico, Greece, Russia and China (Mutch *et al.* 2011). A major challenge for fire agencies will be to recognise that the public is likely to expect both greater safety and a choice in how to respond. Resolving these issues is only likely to be possible if there are open and informed conversations acknowledging the various priorities and perspectives of agencies and the public about how best to respond to the threat of wildfire.

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