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Thinking of Wildfire as a Natural Hazard

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Natural hazards theory with its emphasis on understanding the human–hazard interaction has much to offer in better understanding how individuals respond to the wildfire hazard. Ironically, very few natural hazards studies have actually looked at wildfires, despite the insights the field might offer. This report is structured around four interrelated questions that are often heard from individuals involved with wildfire management. Examining these four items through the natural hazards lens can demonstrate just a few of the ways the field can help us think more clearly about individual response to risk and how to increase participation in fire mitigation and support for fire management practices.

Keywords natural hazards, risk perception, wildland fire, wildland–urban interface

The title of this article may seem disingenuous. Of course wildfire is a natural hazard. However, in fact it has rarely been treated as such in the literature, at least in terms of examining public reaction to wildfire—an important dynamic to understand in finding solutions to the current wildfire problem. Interestingly, only a handful of wildfire studies have included a natural hazards perspective (McCaffrey 2002; Winter and Fried 2001; Cook 1997). Instead, most natural hazards studies have focused on floods, hurricanes, and earthquakes (Rubin 1996). Why this is the case is unclear. Given that early developments in the natural hazards field were in the 1960s and 1970s, eras when efforts to completely suppress wildfire were still reasonably effective, it is possible wildfire simply was not perceived to be a significant hazard.

But now that it has become vividly clear that we cannot fully control every wildfire, there is good reason for looking at natural hazards literature. Although the ecological effects of decades of fire suppression are important components of the current hazard, the immediacy of the problem results from the growing number of people moving into wildland areas who are putting more human lives and property at risk every fire season. A complete grasp of the issue will require understanding the

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problem from as many perspectives as possible. Because the natural hazards field specifically examines the human–hazard interaction, it can provide a framework for understanding how individuals perceive and respond to the wildfire hazard.

Natural hazards research emerged from the discipline of geography and focuses on understanding human adaptation to hazards, particularly individual adjustments (O'Riordan 1986). Fundamentally, the discipline attempts to understand why certain adjustments are favored over others and to explain the mechanisms that affect individual adoption of mitigation measures and policies (Mileti 1994 [1989];[1] Mitchell 1993). Over time, perception became the primary variable to explain the difference between theoretical and actual adjustments (Whyte 1986). By examining how individuals perceived hazards and potential adjustments and identifying which factors influenced differences in perception and choice, researchers hoped to shed light on behavior that had previously been seen merely as maladaptive (Palm 1990; White 1994 [1973]). Two categories were identified that most influenced how an individual responded to natural hazards: (1) factors that affected an individual's awareness and perception of the hazard, such as how long they had lived in the area and past personal experience with the hazard, and (2) ones that influenced how that knowledge translated into action, such as availability of adequate resources to act, expected length of residence, the salience of the hazard in comparison with other daily concerns, and method of calculating the probability of the hazard occurring (Palm 1990; Burton, Kates, and White 1993).

Over time, natural hazards work examining perception began to converge with the field of risk analysis. Risk analysis grew primarily out of engineering and the need to determine the most appropriate means to evaluate the risk associated with new technologies (Kasperson et al. 1994 [1988]). In the 1980s, the disjuncture between the field's emphasis on probability-based risk analysis and the public's more conditional, experiential approach to risk assessment led the field to broaden its area of study. Subsequent efforts to increase consideration of social and cultural values meant work in risk analysis began to have a growing affinity with the perception work already done in the natural hazards field (Plough and Krimsky 1990 [1987]).

In the remainder of the article, natural hazards literature is used to provide insight into four interrelated questions often heard in relation to the current wildfire dilemma: (1) How can people move into high-fire-hazard areas and not see the danger? (2) How can anyone experience a fire and still do nothing? (3) Why do they do nothing even when they've been given information about the danger? (4) Why do people who do understand the high risk still do nothing?

How Can People Move Into High-Fire Hazard Areas and Not See the Danger?

One commonly heard lament is that people either do not understand or ignore the wildfire risk of the areas they are moving into. Such views are not unique to wildfire, and much natural hazards work has been done trying to understand the dynamics of individual risk perception (Palm 1990; Hewitt 1997). Assessing risk involves both judging the likely occurrence of an event and the likely damage that will be incurred. Risk perception is important because if an individual deems the risk low the person is less likely to act to reduce exposure. It is also important because it is extremely subjective, with the level of perceived risk influenced by a variety of issues. Two considerations examined by natural hazards that shed light on this dilemma involve qualitative hazard characteristics and risk estimation abilities.

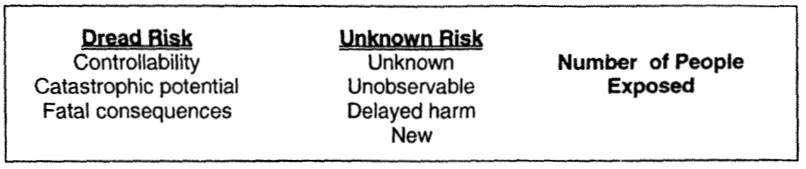

FIGURE 1 Factor analysis groupings of qualitative hazard characteristics found to influence risk perception (based on Slovic et al. 1990 [1979]).

Studies have shown that certain qualitative characteristics of the hazard itself factor into risk estimation (Slovic, Fischoff, and Lichtenstein 1990 [1979]). Hazards that are more pervasive in their effect—that have long duration, affect a large area, and/or are frequent—are more likely to encourage quick and comprehensive change. Hazards that are intensive—with a quick onset, short duration, and/or small area affected—are usually quickly forgotten and provide little reason to do anything (Burton et al. 1993).

In factor analysis of a number of hazard characteristics, Slovic, Fischoff, and Lichtenstein (1987) found two groupings that were highly correlated with each other (Figure 1). "Dread risk" was found to be fairly predictive of risk perception, while "unknown risk" was found to have much less effect. A single variable, the number of people exposed to risk, was also found to be significant, but only in some studies (Slovic et al. 1990 [1979]). The fact that "dread risk" was found to most influence perceived risk begins to shed some light on the wildfire story. In relation to the three key characteristics, wildfire fails to score high: Years of successful fire suppression contribute to a feeling of control; the extent of most wildfires is reasonably limited; and there is generally enough warning to be able to evacuate, thereby avoiding fatalities. Wildfire also rates quite low on the second risk factor of "unknown" as fire is an age-old and well-known danger whose effects are immediate and easily seen. From these perspectives it is not all that surprising that individuals are moving into hazardous areas with little apparent concern. It will be interesting to see if the larger extent of many of the 2002 and 2003 fires and the obvious inability to control them will lead people to revise their wildfire risk assessment.

Another important factor in determining how people perceive risk is how they calculate the probability of a hazard occurring and how much damage will occur. The complexity of causation and high variability associated with natural hazards mean lay individuals must make their risk estimates based on little data and much inference. Individuals whose only active exposure to outdoor fire is around a campfire may find it hard to imagine that, in the right conditions, such a small fire could turn into something that can consume 790 houses in 1 hour as occurred in the 1991 Oakland hills fire (NFPA 2003).

To make the inherent uncertainty associated with any natural hazard more manageable, individuals resort to various mental strategies, often introducing misinformation and bias into their risk estimate in the process (Slovic et al. 1990 [1979]; Slovic et al. 1987). Such strategies include denying the risk outright—"it won't happen to me"—or giving in-place adjustments, such as levees or fire suppression, the power of complete rather than partial protection (Mileti 1994 [1989]; Mileti and Sorensen 1987; Slovic et al. 1990 [1979]). Another common miscalculation is the "gambler's fallacy"—the reasoning that if an event has just happened then it is unlikely to occur again in the immediate future (Burton et al. 1993). The relevant time horizon also may come into play; while many individuals may admit that a

wildfire will happen in their area sometime in the future, they tend to discount that it will happen during the timeframe they expect to be exposed to the hazard (Burton et al. 1993). In a case study of three California communities, Rice and Davis (1991, 7) found that both residents and planners tended to think a fire would not "occur (at least not in the foreseeable futures), in 'my' neighborhood."

How Can Anyone Experience a Fire and Still Do Nothing?

Often experience is seen as an important element in increasing mitigation activities. However, natural hazards studies have shown experience to have an inconsistent effect on increasing risk perception and decisions to mitigate. Because many natural hazards happen relatively infrequently, experience provides a limited and therefore biased source of information. This can lead to misadaptation, as individuals make decisions based on a single experience (Sims and Baumann 1983). In Michigan, a 1990 fire left residents with a view of wildfire as uncontrollable and random, leaving them skeptical of both suppression and mitigation activities. As rationale, they cited the fact that houses with 300 feet of defensible space were destroyed while the fire skipped over vulnerable structures and even came right up to, but did not burn, a woodshed (Winter and Fried 2000). More frequent experience generally increases the chance of a realistic assessment of the likely occurrence and the potential impact of a hazard, and of adoption of mitigation measures (Burton et al. 1993; Sims and Baumann 1983). However, some studies have found that repeated experience with a hazard (e.g., seasonal flooding) may lead to a "disaster subculture" where people become so used to the hazard that it simply becomes part of life and mitigation is not even considered (Tierney 1993). There is also evidence that the most influential type of experience may be indirect, having a friend or relative who was threatened by a wildfire, rather than direct (McCaffrey 2002).

When experience does increase awareness levels and risk perception, its influence often only lasts for a relatively short period immediately following the event (Sims and Baumann 1983). This is why the best time to institute mitigation measures and legal change generally is immediately following a disaster (Mileti 1994 [1989]). Even if experiencing a natural hazard leads to positive change, once the event has become memory often the change is rescinded. In Oakland, a property tax assessment put in place immediately after the 1991 fire to fund vegetation management was not renewed by voters less than 6 years later.

Why Do They Do Nothing Even When They've Been Given Information About the Danger?

It is often suggested that unrealistically low risk perception can be "fixed" by clearly informing the public about the hazard and how to minimize exposure. The assumption is that once individuals are informed of the level of risk and what they can do to minimize their exposure they will act: It would be foolish not to. Perhaps, but work in natural hazards provides little evidence that hazard information automatically leads to increased awareness or that increased awareness will in turn lead to action (Tierney 1993; Neil 1989). Certainly informational material on defensible space can be found going back to the late 1970s, much of it no different from what is provided today, yet only recently has it appeared to catch on. This is not unique to wildfire; while much is known about ways to prevent or reduce losses due to a variety of natural hazards, much of this knowledge is not used (Rubin 1996).

That is not to say that access to information is not important; in fact, it plays a crucial role. Access to information is necessary to make an individual aware of a hazard, including potential consequences and what can be done to minimize damage. Natural hazards studies have shown that as scientific knowledge increases, accuracy of probability estimation also rises (Mileti 1994 [1989]). One wildfire study found a positive association between accuracy of understanding of fire issues and higher risk perception (McCaffrey 2002). However, providing information is not a straightforward process. Assessments of the effectiveness of hazards education for increasing awareness have found mixed results, as well as no consistently effective source of hazard information, whether brochure, radio, or television (Faupel and Kartez 1996; Sims and Bauman 1983). Although written information generally has been more effective than electronic media, in the end all sources "may have counterproductive impacts" (Sorensen and Mileti 1987, 223).

Even if one succeeds in developing material that presents complex hazard information in a way that does not frighten or disconcert people, there is no guarantee that they will not distort the information with their own biases and preconceptions (Slovic et al. 1987). Studies have found that once a risk estimate has been developed it is not simple to change it. Even when estimates are based on limited information, individuals tend to be quite confident of their conclusions (Slovic et al. 1990 [1979]; Neil 1989). Evidence that contradicts the established belief will often be labeled as "unreliable, erroneous, or unrepresentative. As a result, strongly held views will be extraordinarily difficult to change by informational presentations" (Slovic et al. 1987, 36). New information is often forced to fit preconceptions, particularly if its source is not respected or content is deemed weak (Slovic et al. 1990 [1979]; Palm 1994 [1981]; Sims and Baumann 1983). A study of residents of the Santa Monica Mountains found that respondents tended to disregard information on the wildfire hazard from fire departments and insurance companies because they had a low level of trust in them and the information they provided (Loeher 1984). All these factors mean that creating an effective risk information program is difficult.

Why Do People Who Do Understand the High Risk Still do Nothing?

Ultimately, while information can increase risk perception, increased risk perception has not been clearly linked to taking action. High risk perception appears to be a necessary but not sufficient condition. While high risk perception may foster investigation into alternatives, various other factors come into play in the decision to adopt mitigation measures.

Once individuals have identified the full range of adjustments available to them, they engage in two types of evaluation: cost-benefit and implementation feasibility. Cost-benefit analysis involves the financial cost of adjustments and their estimated return over a relevant time frame (Kates 1994 [1971]). In general, relatively high resource levels are needed for mitigation programs to be initiated at either an individual or a societal level (Tierney 1993). This is a relevant issue when considering wildfire mitigation efforts that require removal of large trees or costly retrofits such as reroofing or improving driveway access. The desire for certainty also leads to a phenomenon known as "pseudocertainty," where individuals are more likely to take preventive action when there is apparent certainty of protection as opposed to a probable reduction of risk (Slovic et al. 1987). Thus the fact that one cannot *guarantee* that a house with defensible space will survive a fire provides no check mark in

the benefit column of the analysis. Ultimately, individuals are balancing both the perceived risk and the *benefit* of where they live: The higher the perceived benefit, the greater is the risk tolerance (Slovic et al. 1987). One study found that knowledge that one was buying a home within one-eighth of a mile of California's Hayward fault had no consistent effect on the decision to buy, or on the purchase price, because other factors, such as location and style of house, were more important (Palm 1994 [1981]).

Implementation feasibility includes consideration of the environmental and technical viability of an adjustment: how well it fits with the site and current land use, and the availability of necessary skills, tools, and materials. It also includes sociocultural and personal considerations such as how well the adjustment conforms with personal beliefs and societal traditions, mores, and laws (Kates 1994 [1971]). The American emphasis on individuality and self reliance, for instance, means that there tends to be strong resistance toward any government actions that limit what can be done on private property or that might negatively affect property value (Mileti and Sorensen 1987). For those who have moved into the woods to be close to nature, elimination of trees may be seen as culturally undesirable as well as negatively affecting property value.

No doubt part of the problem lies in the fact that modern lives are complicated and natural hazards generally have low salience compared to other concerns (Neil 1989). So doing anything about a hazard tends to be relegated to the "I'll think about it tomorrow" category. Individuals living in high-fire-hazard areas who saw the dramatic and large fires in Colorado and Arizona in the summer of 2002 probably reacted to the drama with thoughts that they needed to do something on their property. But by November when the fire season had quieted down and was no longer front page news it is likely that daily life activities and getting ready for winter and the holidays took precedence.

Conclusion

As more people move into high-fire-hazard areas, understanding individual behavior—how people can understand the risk, and even experience a wildfire, and still do nothing to decrease their exposure—will be increasingly important. Findings from the natural hazards literature suggest that such seemingly incomprehensible behavior is not unique but fits many of the patterns of individual reactions to other natural hazards. These patterns suggest that there is no straightforward solution to the challenge of increasing homeowner use of and support for wildfire mitigation efforts. As individual response is a complex process involving both subjectively perceived risk and balancing trade-offs, providing information to homeowners will be integral but by no means sufficient to create change.

Land management agencies will need to find ways to make the perceived benefit of mitigation efforts outweigh the perceived costs. Given the connection between accuracy of understanding and heightened risk perception, managers should not oversimplify the problem, but should be specific about causes and how each mitigation activity will decrease risk. The variability inherent in risk assessment suggests that managers may not want to focus solely on the danger from wildfire, but also may want to draw attention to fire's ecological function. Although a fire event can create an opportunity to raise awareness levels, managers also need to recognize and address potential negatives of experience, such as explaining why defensible space didn't work and highlighting where it did. The finding that indirect experience can be

influential suggests that managers may be able to use nearby fires and testimonials of fire victims to increase awareness and the desire to act.

Agencies can facilitate implementation feasibility by identifying barriers to use of defensible space and finding ways of making it easier for homeowners. For example, in several places providing free chipping and hauling services for removed vegetation has been quite successful in increasing vegetation management by homeowners. Policy-level changes, such as providing financial incentives to make needed changes in already developed areas and creating zoning and building codes for future developments, could also increase use of fire-safe practices.

This article shows the applicability of existing natural hazards research to wildfire, but there is also a need for studies that apply natural hazards findings specifically to wildfire. Do the same factors influence risk perception for fire? How do ecological and forest health values fit into the cost-benefit analysis? Is there an information source that is more effective than others? Some of this research is already in progress but there is room for much more. Ultimately a better understanding of barriers and of what factors are likely to create more positive attitudes toward fire mitigation efforts can do a great deal to direct resources more effectively.

Successful wildfire mitigation will require change at both the communal and individual levels. Natural hazards research can provide significant insight into individual attitudes and behavior in the face of wildfire risk. With its recognition that individual response to a natural hazard is a complicated process, the natural hazards field provides a base for understanding key individual factors to consider as well assumptions to avoid. This will be a critical step in decreasing risk in fire-prone areas.

Note

1. For several books that feature reprints of key natural hazards articles, I have chosen to include both dates, with original publication date in brackets, as both are indicative of each article's enduring importance.

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