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## Understanding Public Perspectives of Wildfire Risk

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In recent years, heightened attention to the social dimensions of wildfire has led to increased discussion of wildfire risk. One focus has been on the need to enhance the wildfire risk perception among homeowners living in high fire hazard areas. The underlying supposition is that once they understand risk, homeowners will then take action to reduce their exposure. This is based on two assumptions: that definitions of wildfire risk will be consistent across groups and that increased risk perception will necessarily lead to taking action. These assumptions are problematic, however, as research on other natural hazards has not found consistent evidence supporting either of these views (McCaffrey 2004a).

Research has shown that risk perception is not simply a scientific concept, but also a cultural one shaped by individual and societal values. As Slovic (1999a) states, "Risk is a subtle concept with many possible meanings. It is sometimes used as a synonym for a hazardous activity, sometimes used to mean probability, sometimes used to mean a consequence, and sometimes used to mean threat." Perceived risk of a natural hazard is generally defined as how serious the threat is deemed to be coupled with the "subjective probability of experiencing a damaging environmental extreme" (Mileti 1994). Thus perceived risk has much room for variation, as different groups may consider a threat to be more or less serious and probability can be a highly subjective calculation.

Wildfire risk is no exception to this variability. "The phenomenon 'fire' has as many aspects as people who are dealing with it: Fire managers and fighters, environmentalists, foresters, house and land owners, scientists, land planning organizations, etc. Based on their primary interests, each of these communities has different notions of the term 'wildfire risk'" (Bachmann and Allgoewer 2000). Yet if the individuals and groups mentioned above that are working to mitigate the fire hazard are highlighting high fire risk in their

outreach efforts to encourage defensible space or support for fuel treatments, it is important to understand whether the public's conception of high wild-fire risk is the same as that of those who are designing and implementing the outreach efforts.

This chapter focuses on the first of the two problematic assumptions set forth above by reviewing various approaches to understanding risk and how different groups define the term, then examining the results from a series of 2004 focus groups to learn how members of the public define wildfire risk and what shapes their reactions to it. I was part of a team of researchers at the North Central Research Station of the USDA Forest Service that worked with a professional facilitator to conduct the focus groups, which took place in the western United States and included discussions related to public conceptions of wildland fire risk.

## **Different Approaches to Understanding Risk**

The modern scientific approach to risk analysis grew primarily out of engineering and the need to establish reliability and safety standards for new technologies such as nuclear reactors and pesticides (Kirby 1990). The field focused on determining the most appropriate means to evaluate risk, with a heavy emphasis on probability and expected utility theory. Initial assumptions that people's actions would be directly related to the calculated probability of the event and the magnitude of its consequences proved problematic, however, as a significant disjuncture often was found between this probability-based risk analysis and the more contingent, experiential risk assessment of the public (Plough and Krinsky 1990). As a result, those working in the field had difficulty explaining why there were strong public reactions to risks that technical experts considered minor (Kasperson et al. 1994).

To understand why this occurs, researchers began to explore what shaped public perceptions of risk. Over time, studies have examined whether laypersons see risk as a combination of probability and consequences or consider only probability, and what combination most influences decisions to mitigate risk (Sjoberg 1999a; Slovic 1999a); differences in expert and lay calculations of risk, and whether the two groups indeed perceive risk differently (Johnson 1993; Rowe and Wright 2001; Sjoberg 1999b); and the influence of hazard characteristics on risk perception (Slovic 1997). A more recent focus has been on understanding how emotions play into risk perception, including how negative or positive emotional assessments associated with exposure to a hazard influence risk perception (Slovic 1999b) and the role of visceral emotional response to risk and uncertainty (Loewenstein et al. 2001).

It is not entirely surprising that definitions of risk differ. The dynamics of risk perception are complicated. In essence, efforts to determine risk exposure are an attempt to bring some level of certainty to an uncertain and

threatening situation. Technical experts develop a set of protocols, generally using mathematical calculations, of ways to deal with this uncertainty. "After identification of the failure or damage scenarios (what can go wrong?) the questions are: what are the potential consequences and their likelihoods? The risk can then be quantified by a probability distribution of the potential outcomes, or by the relevant moments of that distribution" (Pate-Cornell 1996). Although this quote makes technical risk assessment sound like a straightforward process, that is not necessarily the case. Such an assessment can provide different results for the same concern, depending on both how the negative consequences are defined and how probability is calculated. For instance, defining a risk in terms of accidental deaths per product unit versus accidental deaths per number of employees can yield very different outcomes (Fischhoff et al. 1984). Further, different groups of scholars have different understandings of probability (Pate-Cornell 1996), with each group potentially using different levels of mathematical sophistication to calculate risk.

Given this lack of agreement among experts, it is unlikely that laypersons will be any more consistent in their risk assessments, nor do they have the time or inclination to use complicated mathematical calculations in their assessments. Instead, they tend to use various mental heuristics, such as denial or attributing complete protection to adjustments (such as flood levees) that provide only partial protection, to minimize the uncertainty and make the hazard seem more manageable (Slovic et al. 1990). In the process, they often introduce misinformation and bias into the risk estimate (Slovic et al. 1987). In addition, some individuals may decide to emphasize probability in their assessments, whereas others may emphasize negative consequences, often focusing only on specific types of impacts, such as death. Finally, whereas experts tend to focus on numerical risk assessment, laypersons' response to risk likely includes emotional components—particularly visceral response to the risk—which may or may not conflict with their own more objective cognitive evaluations (Loewenstein et al. 2001).

Similarly, the fire community has no consistent definition of wildfire risk. Most formal definitions tend to treat the term as solely about probability. The Canadian Committee on Forest Fire Management defines it as "fire probability or chance of fire starting determined by the presence & activation of causative agents" (Bachmann and Allgoewer 2000). A recent U.S. General Accounting Office (GAO) report on the need to systematically assess the environmental risks of wildfires defines risk as "the probability that an event such as a wildland fire will occur" (GAO 2004). Neither of these definitions includes consideration of consequences. In fact, in their analysis of how wildfire risk is treated in the literature, Bachmann and Allgoewer (2000) found few examples that considered both probability and outcome.

Does the public definition of wildfire risk also emphasize probability with little to no consideration of negative consequences? Only a few studies have asked members of the public to estimate probability of a fire in the general area

versus one that would actually damage their property (Gardner and Cortner 1985; Winter and Fried 2000b) or examined the underlying dynamics of wildfire risk perception (Nelson et al. 2004).

## Exploring Public Conceptions of Wildfire Risk

The rest of this chapter examines conceptions of wildfire risk among members of focus groups held in the western United States as part of a study we undertook with the overall purpose of examining public views on wildfire management. One section of the focus group discussion explored risk perception, particularly what members of the public take into account when they assess wildfire risk.

### *Methods*

We had a professional facilitator conduct 15 focus groups from May to July 2004 in five fire-prone areas of the western United States—Boulder, Colorado; Flagstaff, Arizona; Hamilton, Montana; Reno, Nevada; and San Bernardino, California—recruiting participants via phone calls using a geographically targeted sample list. As our purpose was to obtain perceptions from the general populace rather than those with a particular interest in wildfire issues, we excluded from the sample anyone who was employed by a government agency with jurisdiction over forestry or air quality, had any affiliation with the logging or timber products industry, or worked with any firefighting organization. We established quotas to ensure an appropriate cross section of the population.

Three focus groups took place in each location. Our intention was to have one group consisting of those who lived in the wildland intermix, where houses are dispersed throughout native vegetation; one of residents of the interface, areas on the edge of town or with moderate levels of native vegetation; and one of vicinity dwellers, who lived in town or predominantly agricultural areas. We assigned respondents to a group based on their identification of the landscape where they lived. While the focus groups were being conducted, however, it became evident that individuals living in the same neighborhood and even on the same street could characterize their surrounding landscape very differently. (This interesting dynamic merits further analysis.) We then mapped the addresses and, based on field assessments at the time of the focus groups and use of satellite photos via TerraServer, assigned participants to the appropriate landscape group. Focus group size ranged from 8 to 15 participants, with an average size of 11 and a total of 171 participants. We recorded and transcribed all groups, systematically coded the transcripts for analysis using N6 software, and then verified the coding reliability via repeat coding of random sections and comparison of results.

When we found patterns, we reviewed the text for alternative explanations or negative evidence. For instance, we found some indication that participants who lived in town had a less accurate understanding than those who lived in the intermix of what factors made their houses more vulnerable to a wild-land fire. Upon review, however, we discounted this pattern, as a fair number of participants who did not live in town also had misconceptions about what placed their houses at risk.

Early in the discussion, participants rated on a scale of 1 to 10 the level of wildfire risk for the general area (area risk). They then told what factors they considered when they made that rating. Subsequent discussion explored how they differentiated between high and medium risk, from what sources they received information on the risk, and whether they thought the risk messages they were receiving were accurate. Finally, participants rated the wildfire risk level for their houses (house risk).

## Results

Overall, participants saw the wildfire risk in their areas as quite high, but it also was evident that risk is indeed a subtle concept. Several participants wanted clarification on the time frame, weather conditions, and spatial extent to be considered, as well as risk to whom.

*I didn't know if you were asking how likely do you think a fire is to happen, in which case, it happens every year around here, so it's highly likely. Or how likely is it for a fire to kill somebody or burn down lots of houses. (Hamilton vicinity)*

But as discussion progressed, a distinct and fairly logical pattern of wildfire risk perception emerged. First participants generally thought about environmental conditions that would affect the odds of a fire breaking out and influence its likely behavior. Next they thought of ignition sources. Although some mentioned lightning, the most common ignition source discussed was human actions, usually in the form of "stupid people."

*I think of a really dry forest. I picture a fire about to happen. Mostly it's the condition of the forest because stupid people are always around. (Boulder vicinity)*

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Ann: *I think of bitterbrush and manzanita that's packed up to each other with the dry, dead trees and cheat grass coming from the highway. I can just see it light*

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John: *I think of my dad, jogging around the basin, coming to visit me and throwing a cigarette out the window. (Reno intermix)*

The San Bernardino interface and intermix groups were an exception to the general pattern of considering environmental conditions first in determining

wildfire risk. Two-thirds of these participants had had to evacuate their residences as a result of the large fires of the previous fall. For these two groups, wildfire risk first brought to mind likely human impacts, including emotional responses.

Moderator: *When you see the words “wildfire risk,” what do you generally think of?*

Paul: *Evacuation.*

Marc: *Fear.*

Allen: *Panic, because people don't have escape routes.*

Anna: *Or how fast that the fire can come, depending on the vegetation.*

George: *I think of dry brush. (San Bernardino interface)*

After ignition sources, participants considered likely damage, looking first at human costs—houses, health, lives—and then at harm to the forest and wildlife. It was at this point that participants began to move beyond discussing risk primarily in terms of probability to talking about it in terms of the context of the situation and likely negative consequences.

*Well, the thing I think was missing in the previous discussion was risk to dwellings. I don't think any of us would be concerned about a wildfire in the jungles in Ghana, for instance. We would be maybe a little bit more concerned about the risk of a wildfire in the Lost Horse Drainage, for instance. But it starts getting to be personal when you can see the fire. So it really gets to be a crisis when it is encroaching on your property and threatening your house. (Hamilton interface)*

Although participants generally did not talk about negative impacts overtly until after consideration of environmental conditions and likely ignition sources, they implicitly considered these aspects from the start, as they discussed environmental factors mostly in terms of the amount and dryness of fuel and other variables that could contribute to a less controllable and more damaging fire. That negative consequences were an underlying part of most people's definitions of risk became evident when they explained how they would differentiate between high- and medium-risk wildfires. Answers focused on environmental factors—such as wind speed, humidity, combustible fuel, and topography—that would increase the likelihood of a fire being uncontrollable and more damaging.

Moderator: *In what ways would a high wildfire risk situation differ from a medium risk situation?*

Male 1: *One uncontrollable.*

Female 1: *It would spread easily.*

Female 2: *How deeply it would burn if you have a wildfire that burns so hot that it burns all the organic matter, so things can't grow back. That's the extreme.*

Female 3: *Risk to residences.*

Male 2: *Of course the wind factor.*

Male 3: A wildfire doesn't have any natural breaks that slow it down, you know, it just keeps going in the crown.

Male 2: Evacuate from the area. (Flagstaff interface)

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*I think the other thing that I think of when I see high risk, is it going to be really difficult to get under control? That's just my initial thought is if it is really high risk, that if something does take off, then we are at risk for greater damage. (Boulder vicinity)*

**Risk Messages.** Most participants generally felt there was little disjuncture between their perception of wildfire risk and the various public messages they were getting about the risk. Some believed it was being understated, whereas others thought it was overemphasized in order to generate fire-fighting funds. The most consistently mentioned information source was the roadside signs that indicate the current fire risk. More than half of the focus groups mentioned the signs, often listing their locations, and several participants said it was what they first thought about when they heard mention of wildfire risk.

*I think of the signs . . . there's I guess some type of fire prevention sign right there, but a barometer that goes to the different shades. When I see it go into the orange I know that . . . It's frightening, I hear that and feel fear. (Boulder interface)*

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Austin: We see the signs on the road, she's referring to. Today the fire danger is low.

Lynn: Elevated, kind of like what they use for Homeland Security.

Austin: Everybody sees those signs, it does make you conscious. (Reno intermix)

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*I personally don't think about it until I pass our Ranger Stations and it says on the sign, "Extreme Risk of Fire." And that is a subtle reminder that, "Hey, this is a danger area." (San Bernardino intermix)*

These last two comments show the importance of the signs not just in terms of recognition, but also as a means of ensuring that residents do not put the risk out of mind. They also highlight the importance of keeping the signs current. It was evident that people paid attention to the signs in part because they trusted the messenger, but also because the signs supported their own observations.

*I agree with it (the sign) because they wouldn't be making it up. And it looks dry and we haven't had rain and I would go with that. (Boulder vicinity)*

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*I usually agree, but the other day I rode my bike out there and the sign said low. This was a week ago. We've had some rain, but I still don't think it is very low. (Boulder intermix)*

**Area Risk.** When participants rated the wildland fire risk for the general area on a scale of 1 to 10, an interesting pattern emerged. Participants who lived in the vicinity consistently had a higher wildfire risk rating for the area than those who lived in the intermix or interface. Although the structure of the focus groups did not make it possible to clearly establish why this distinction existed, there were indications that part of the difference may be a result of self-selection, with those who saw too high a risk having chosen not to live in the intermix or interface. This kind of decision process was evident among participants in Flagstaff, Boulder, and Reno.

Female 1: *We aren't allowed to burn at all at my house. (Flagstaff intermix)*

Female 2: *Well, you are in a canopy. You are right there in a canopy. That's one reason we didn't buy up there, I was terrified. (Flagstaff vicinity)*

Female 1: *We are a 7 risk and that's why we didn't sell that house, and just move away. We want our kids to experience living on a piece of beautiful, beautiful land that is not, it is relatively undisturbed by society. You can go out on the trail, right from your door, and see wildlife and be right in nature. So that risk is worth that. . . .*

Moderator: *Is having a wildfire risk of 7, is that acceptable to you?*

Female 1: *Oh, you know; you still have everything else. Although, I guess I should fess up, we also bought a condominium in Boulder. (laughter) So, I have to tell you, my husband would deny this, but for me part of the fear is about wildfire. I do not want my kids out on the street without a place to be. So, there's a lot of other reasons why we did it, but we have a separate home. (Boulder intermix)*

*I think there's something to be said about living out rural or in the country. I don't want that taken away from me. Even if there's brush around and there's a potential for fire, I think we take that into consideration when we buy our houses. (Reno interface)*

The first two quotes indicate that the self-selection is based in part on emotional responses. Both participants referenced powerful negative emotions to explain their decision to have a residence outside of the interface or intermix, thus indicating that their risk perception was not a simple utilitarian calculation based on probability and outcomes.

Another likely dynamic, illustrated by the last two quotes, is that people who live in the intermix and interface are making conscious trade-offs. The open discussion of the positive benefits of living in these areas and the lower risk ratings of people living in them parallel findings from other risk research of an inverse



relationship between perceived benefits and risk perception: higher perceived benefits are associated with lower risk perception (Alhakami and Slovic 1994). This dynamic is linked with a person's overall positive or negative emotional (or affective) response to a hazard: a positive emotional reaction is associated with a lower risk perception. The need for cognitive consistency means that individuals who have decided that living in or near wildland areas is desirable engage in mental strategies that minimize the risk and highlight the benefits, making the trade-off acceptable. Although Alhakami and Slovic's study was in relation to risks and benefits at the societal level, these findings suggest that a similar process exists at the personal level. This dynamic appears to some degree in one intermix resident's explanation of why she rated her house risk so low.

*Because the only wildfires I've ever seen, I've only been here for 7 years, so it always has been near to the peaks and not near my home. Just the state of the woods around my house, I go hiking through the woods around my house a lot, and they seem pretty healthy to me. Maybe I just would like to think that I'm safe. (Flagstaff intermix)*

It is also possible that those living in high-risk areas had engaged in mitigation around their houses, which almost all intermix and interface residents indicated they had done, and these actions in turn lowered their overall risk perception.

**House Risk.** Participants were also asked to rate their houses' wildfire risk. Ratings followed the expected pattern, with intermix residents having the highest risk ratings and vicinity residents the lowest. Views of house risk were uniformly lower than assessments of area risk. Notably, a statistically significant difference (t-test significance level of 0.009,  $n = 166$ ) was seen in house risk assessment by gender, with women having higher house risk ratings than men. This matches findings in other risk research that in general women tend to have a higher sense of risk than men (Slovic 1997), although no such gender difference existed for ratings on area risk.

Responses indicate that participants generally had a good understanding of which factors increased their risk, including shingle roofs, thick vegetation and ladder fuels, flying embers, unraked pine needles, and topography.

*I said 5 because we live on a hill. We get the winds almost as bad as Washoe Valley. Of course, we have a cement roof, that's a good thing, we have defensible space, but we also have a lot of natural brush around our house, all around our home. All our 6 acres and the adjacent area. If the wind is right and the fire in the right place, we could be in trouble. (Reno interface)*

Most intermix and interface participants indicated that they had done some type of mitigation work, particularly vegetation management and replacing

shingle roofs. Several indicated they felt their house risk was lower as a result of these actions.

*I said 4 or 5 because on our own particular lot, we've taken out half the trees that were there when we bought the lot and we built the house at least 15 feet from the closest trees. We rake pine needles incessantly, so there's no cover on the ground. And, we are on the edge of A-1 Mountain, the foothills, and just this last winter they thinned it. Especially near our house. They took out 2/3 of the trees for 100 yards back of our house. So I think compared to 7 years ago, I would have said a 7 or 8; now we are at a 4 or 5. And our house partly has fireproof siding and a steel roof. (Flagstaff intermix)*

Similarly, there was evidence that people had increased their house risk ratings as a result of information they had received about the wildfire hazard. However, there also was evidence that individuals could understand wildfire dynamics and still deny the risk. Both are illustrated in the following exchange.

Male 1 (5 rating): *Two years ago I would have said zero. Until you see the footage of the wildfire that took the camp out up by . . . in the middle of a meadow. It is just amazing, the winds that get generated by a wildfire come across the flats and nothing is safe.*

Female 1: *I said zero, but we live up in Corvallis, and when we had the big fires in 2000 up Dutch Hill, way up there by Pinesville, we found big embers in our yard where the wind had blown them down there. So it might not have been in the middle of a wildfire, but it could have been our house that was on fire from it. (Hamilton vicinity)*

Ironically, this last person rated her house as having no risk but then went on to describe a very logical way the house could in fact be lost to wildfire. Such apparently illogical justifications were more prevalent in explaining house risk ratings than they were for area risk. Loewenstein et al. (2001) argued that a key part of lay risk response is linked to the immediate visceral reaction to the risk, which is closely linked to the vividness of the mental imagery associated with the risk. Losing one's house to wildfire likely engenders more vivid imagery than a more general wildfire in the area, which may encourage people to engage in mental heuristics to minimize their personal sense of risk. This possible dynamic may provide some explanation for why some homeowners may have an accurate assessment of the overall area risk but still not engage in any defensible-space measures.

## Conclusions

This chapter has discussed the general variability in how people define risk and examined what members of the public consider when they assess wildfire

risk. Participants in focus groups in fire-prone areas recognized a wide range of topics, including environmental conditions, vegetation and building structural characteristics, potential fire behavior, and negative consequences, when considering both their overall wildfire risk for the area and the risk exposure of their properties. The sophistication of participant discussion of wildfire risk plus the high recognition of fire risk signage indicate that fire risk information is being communicated effectively.

Findings point to the need for continued communication as well. The attention participants gave to the fire risk signs shows the need to keep them current, not just for actual fire risk understanding, but also to maintain trust in their credibility. The strong initial emphasis on environmental conditions as a key part of risk assessment also indicates that managers may need to pay the most attention to communicating about fire risk when the conditions do not visually support the actual risk, such as when vegetation does not appear dry or dead. In addition, the fact that a significant number of participants asked for clarification about what area risk meant suggests a need for managers to clearly explain the definition of wildfire risk they are using, including time frame, area extent, and specific type of damage.

Strikingly, participants who lived in the wildland-urban interface had a lower sense of wildfire risk for the area than those who lived in town. In assessing their own property risk, the more expected pattern was found, with interface residents having a higher sense of house risk. The fact that those living in the intermix and interface have a lower sense of general fire risk than those living in less exposed areas is intriguing. Although further research is needed to clearly understand this dynamic, it does suggest one reason why work to increase wildfire risk perception does not necessarily lead to behavior change. Residents in these areas appear to have already recognized the risk in some manner and made decisions, conscious or unconscious, that either they are unwilling to tolerate it or the benefits outweigh the risks.

Overall, findings demonstrate that risk perception is indeed a subtle concept and that the dynamics of lay response to wildfire risk are not substantially different from those related to other natural hazards. Public response to high fire risk that managers may see as too passive may not necessarily be a result of lack of recognition of the risk, as is often assumed. Instead, results show that interpretation and response to wildfire risk are highly variable. Individuals exposed to the same risk may respond differently based on their interpretations of a variable array of external factors, such as topography and environmental conditions, as well as more personal considerations, such as risk tolerance and perceived benefits of exposure. Given this complexity, it is not surprising to find a variety of reactions and responses to the same wildfire risk. This suggests that although it is important to continually communicate risk information, outreach efforts with too singular a focus on defining and quantifying wildfire risk as a means to engage the public are unlikely to be effective. Instead, communication work may need to focus on addressing

other variables that shape response to risk, such as highlighting how efforts to decrease risk can add to rather than subtract from the perceived benefits of living in fire-prone environments.

As this chapter indicates, individuals and communities comprehend risk in a variety of ways. The research presented here is consistent with the overall message in this volume: risk is a multidimensional concept, and those working to effect changes in the behavior of individuals and communities need to incorporate this complexity in their risk communication messages. If the risk mitigation messages do achieve this goal and obtain “buy-in” from individuals and communities, then the programs will be effective at reducing the risk posed by wildfire.