



# Science Bulletin

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## Fire on the Mountain: What Motivates Homeowners to Reduce Their Wildfire Risk?



*The financial costs of fighting fire in the WUI are enormous – in one survey of land managers, they estimated that between 50 and 95% of firefighting expenditures were attributable to defense of private property. (Photo credit: Bryan Day)*

In the most fire-prone areas of the country, new homes are being built faster than ever. It is [estimated](#) that between the years 1990 and 2008, there were roughly 17 million new homes built in the United States, of which 10 million (or 58%) were located in the “wildland-urban interface” (WUI)—the term for forested areas into which communities are expanding. The [financial costs](#) of fighting fire in the WUI are enormous: One survey of land managers estimated that between 50 and 95% of firefighting expenditures were attributable to defense of private property. The tragic, recent

deaths of nineteen Granite Mountain Hotshots who were trying to save evacuated homes in Yarnell, Arizona, brings the human cost of fighting fire in the WUI into sharp focus. Future WUI development in the western United States will be driven by both demographic trends and the allure of the abundant natural amenities. It is expected that development rates in these landscapes will grow as a rising wave of retiring baby-boomers crests in the middle of the current decade and creates a large migration of people attracted to the lakes, mountains, and forests.

### SUMMARY

New home building in the wildland-urban interface (WUI) continues unabated, despite the high financial and human costs of fighting fires in these areas. The goal of this research is to understand, through surveys and expert assessments, the attitudes and perceptions of WUI homeowners as they relate to taking action to reduce wildfire risk on their property. It also addresses whether there is a difference between their perceptions of the wildfire risk on their property and an expert’s assessment. In a two-county survey in Colorado, it was found that the most important sources of information for WUI residents that were related to taking action were “informal social networks” (such as talking with neighbors) and guidance from local fire departments and county wildfire specialists. Higher risk perception and/or previous experience with wildfire was also associated with higher mitigation levels. A major wildfire in the area did little to change homeowners’ overall attitudes towards wildfire, but it did increase their level of concern for their property, landscape, pets, and health. A separate study in Ouray County, Colorado, found that homeowners tended to underestimate their wildfire risk compared to an expert assessment of their property. This research helps to further our understanding of how education and outreach can play a role in moving homeowners to better understand the ongoing risk that wildfire poses in the WUI so they can take appropriate steps to protect themselves and their property.



WUI residents, vulnerable as they are to wildfire, can take many concrete steps to become “firewise” to protect themselves and their properties. Some of the most effective actions are to build or retrofit homes using fire-resistant material for the roofs, siding, and eaves, and to create a buffer zone of defensible space around the house by managing vegetation. But will homeowners undertake wildfire mitigation? Why or why not? Currently, there is little in place to force homeowners in the Intermountain West to do anything to help protect their property from wildfire. Many of the residents of WUI communities are skeptical about regulatory intrusion when it comes to managing their personal property, and although recent wildfires may have started to push the issue, regulations have been slow coming in the Intermountain West. Losses due to other factors (hail damage in Colorado, for example) still exceed those due to wildfire in a typical year, and insurance companies have yet to create any significant mitigation requirements as part of their underwriting. Without significant risk-reducing mandates coming from institutions or regulators, it is up to communities and individuals to be proactive in taking steps to reduce risk to their own lives and property. For this to happen, they need to be both educated about and motivated to perform wildfire mitigation on their property.

Teasing apart the many factors that influence the attitudes and behavior of WUI homeowners is the goal of collaborative effort between Rocky Mountain Research Station research economist Patty Champ, and her colleague Hannah Brenkert-Smith, a researcher at the Institute of Behavioral Science at the University of Colorado-Boulder. Using both socio-economic

***According to research economist Patty Champ, homeowners “really valued the information from the county wildfire specialists, who would come on their property and mark trees and say—cut this one, keep this one.”***

research methods to analyze homeowner surveys and expert assessments of homeowner efforts on their property, Champ and Brenkert-Smith are moving us closer to an understanding of what actually motivates homeowners to take the action needed to reduce their personal risk of loss. This understanding can translate directly into concrete efforts to get the highest possible level of community participation and minimize the number of homes and lives lost to wildfire.

#### **INSIDE THE MIND OF THE WUI HOMEOWNER**

There are many sources of information available to homeowners explaining how to reduce the risk of losing their home to a wildfire, but information and education do not always translate into action. At the heart of the matter is the question of what it takes to get people to change their behavior to reduce their risk of loss. According to Hannah Brenkert-Smith, this can be viewed through many different lenses: “We can ask, does it have to be a really scary or immediate threat? Are there obstacles to taking action? Does it cost too much to cut a tree down? Or is there a lack of specific information?” These are the types of questions that interest researchers who try to understand the relationship between risk and human behavior. In this case, they want to know what is it, precisely, that will push landowners to take action, or what the barriers are that prevent them from doing so. In other words, how can landowners

be persuaded to spend their hard-earned money on something like replacing a highly-flammable wood shingle roof?

It turns out that some types of information are more valuable to the WUI homeowners than others. When Patty Champ and Hannah Brenkert-Smith became interested in WUI homeowner attitudes, they started with in-depth interviews with residents in two Colorado counties, asking them questions to learn where they got their information on reducing wildfire risk. Their initial assumption was that “institutional arrangements”—for example, formal programs and homeowners insurance—would be the main factor affecting mitigation activity. But when they spoke to homeowners, they found that informal social networks—people talking to neighbors about mitigation and noticing actions of others in their community—were the important avenues for information transfer. Also, according to Patty Champ, “They really valued the information from the county wildfire specialists, who would come on their property and mark trees and say—cut this one, keep this one.”

Formal surveys funded by the counties were then developed that allowed for a closer look at the underpinnings of homeowner attitudes about wildfire and risk. According to Patty Champ, “In the surveys, questions were asked to get at which attitudes and sources of information are related to

homeowners taking mitigation action.” The questionnaires, which were sent by regular mail but also allowed for online responses, were addressed to a random sample of WUI residents in 2007 in both Larimer and Boulder Counties in Colorado and covered a broad range of issues related to wildfire mitigation on their property. Some of these questions addressed specific conditions on their property (e.g., density of vegetation, etc.), and whether or not they had undertaken any mitigation activities (e.g., limbing trees close to the house, thinning vegetation, replacing a wood-shingle roof). The researchers then examined larger issues having to do with level of concern about wildfire and attitudes about risk and responsibility. Importantly, the researchers found that higher levels of mitigation activity were associated with having received information from local fire departments and county wildfire specialists, as well as talking with neighbors about wildfire, which is in line with the results from the previous interviews. Homeowners who had firsthand experience with wildfire, such as preparing for evacuation or actually evacuating, also reported higher levels of mitigation. In general, those who perceived higher wildfire risk on their property—whether due to information gleaned through social networks, previous experience with wildfire, or other reasons—had done more to reduce their risk. (Here you can find the survey results for [Larimer](#) and [Boulder](#) Counties.)

### CLOSE TO THE HEAT

In September 2010, three years after data had been collected from the formal surveys, a wildfire ignited in Fourmile Canyon in the foothills west of Boulder. By the time the fire was contained eleven days later, it had destroyed 169 homes, making it the most destructive fire in



*Aerial view of the Fourmile Canyon area. Steep slopes, dense ponderosa pine and Douglas-fir forest, and mixed-land ownership characterize this wildland-urban interface zone near Boulder, CO. (Photo credit: Joe Amon, The Denver Post)*

Colorado history at that time. Patty Champ and Hannah Brenkert-Smith saw this disaster as an opportunity to learn about change in homeowner attitudes over time and after a major fire event. Funded by the Colorado State Forest Service and the National Center for Atmospheric Research, Patty and Hannah developed follow-up surveys to examine how a major fire event close-by affected homeowner attitudes towards risk and mitigation. These surveys were administered to the 2007 survey participants in Larimer and Boulder Counties.

The researchers saw five major changes when comparing the responses from before and after the Fourmile Canyon Fire. First, WUI residents reported a change in fire-related experiences, since more respondents had experienced an evacuation (this was true only in Boulder County, the site of the wildfire). Second, there was an increase in concern about wildfire damaging their homes

or property, which the researchers attributed to the increased awareness following the fire (see figure 1). Third, more people thought vegetation on their own property and their neighbors', as well as the characteristics of their home, affected their wildfire risk. Patty Champ explains that “these were key messages in the education programs that were also going on at the time—the county seems to have gotten the word out.” People also reported undertaking more mitigation action on their property after the fire, such as limbing trees, changing over to fire-resistant sidings, and thinning vegetation. Finally, more people thought it likely that if a wildfire were to come through their property, their home would be destroyed or suffer smoke damage, or the surrounding landscape would be destroyed. Although there may have been additional factors involved besides the Fourmile Canyon Fire in shaping people's attitudes and behaviors (such as the weak economy and stronger county-wide efforts at homeowner education),



*It is estimated that between the years 1990 and 2008, there were roughly 17 million new homes built in the United States, of which 10 million (or 58%) were located in the “wildland-urban interface” (WUI). (Photo credit: Rocky Mountain Research Station)*

**Figure 1.** Wildfire concern levels reported by Boulder County, Colorado “WUI” residents before (2007) and after (2010) the Fourmile Canyon fire.

| How concerned are you about wildfire damaging or affecting the items listed below? | Percent reporting 4 or 5<br>(1 = not concerned at all;<br>5 = very concerned) |      |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------|
|                                                                                    | 2007                                                                          | 2010 |
| Your house or other buildings on your property                                     | 47%                                                                           | 60%* |
| Your property/landscape                                                            | 44%                                                                           | 54%* |
| Public lands near your home                                                        | 43%                                                                           | 50%  |
| Your pets                                                                          | 27%                                                                           | 42%* |
| Your health or your family’s health                                                | 28%                                                                           | 36%* |
| Local water sources                                                                | 22%                                                                           | 28%  |
| Your ability to earn income                                                        | 11%                                                                           | 16%  |

\*differences between 2007 and 2010 results were statistically significant.

these statistically significant changes in responses suggest that people did gain a better understanding over those three years about wildfire risk and how they might be affected.

### BRINGING IN THE WILDFIRE EXPERTS

It is not uncommon for the public to label homeowners who chose to build or buy homes in the WUI as irresponsible, expecting to be rescued by government firefighters when a fire breaks out and

then made whole by insurance companies after the fact. But is this really a fair assessment? To what extent do WUI-dwellers fully understand the risk that comes with their surroundings? Do these homeowners take reasonable efforts to protect themselves and their property? The surveys that were conducted in Larimer and Boulder Counties suggest that most people who have purchased a home in a fire-prone area report having been aware of the risk of wildfire at the time of purchase. Additionally, results indicate that they do take measures to mitigate, but the main limitation of the results is that they are self-reported. Think of the questionnaires that you fill out at the doctor’s office regarding number of drinks consumed per week, or frequency of exercise: How accurate are your self-reported answers? For wildfire mitigation and self-reported survey results, what if homeowners think they’ve done a good job mitigating on their property, but they haven’t actually done so? It would be useful to know what the difference is between the level of mitigation that homeowners report they’ve completed, and the level of mitigation that a professional would measure on their parcel.

Patty Champ and Hannah Brenkert-Smith, through a collaboration with the [West Region Wildfire Council](#) (WRWC) and the BLM, are measuring whether such a gap exists, and if so, how large it is. In the Log Hill Mesa neighborhood in Ouray County, Colorado, the members of the WRWC completed a census of all 600 households. A wildfire specialist from WRWC visited each property and looked at ten attributes that relate to parcel-level risk, including: access in and out, building materials, proximity to dangerous topography, degree of dense vegetation close to house, and

*Survey questions were developed “to get at whether or not there is a misperception; for example, the homeowner believes that their risk is low, but they actually have dense vegetation near their house,” explains research economist Patty Champ.*



*Patty Champ and Hannah Brenkert-Smith’s research asks questions such as, to what extent do WUI-dwellers fully understand the risk that comes with their surroundings, and do these homeowners take reasonable efforts to protect themselves and their property? (Photo credit: Rocky Mountain Research Station)*

background fuels characteristics. These ten attributes were assigned a point value—the more points, the higher the property risk (for example, a wood-shingle roof amounts to a lot of points). They then compiled the results for each parcel into five risk levels, from low to extreme. To compare this with a homeowner self-assessment, Patty Champ explains, “They developed survey questions to get at whether or not there is a misperception; for example, the homeowner believes that their risk is low, but they actually have dense vegetation near their house.”

The analysis of these data has allowed the researchers to answer many questions that they couldn’t address with the surveys alone. The main question of interest is, of course, how did the homeowners do with their self-assessment? According to Patty Champ, “Overall, people underestimate their wildfire risk.” Hannah Brenkert-Smith further explained that this underestimate was not huge, but it was consistent. She says, “Across the five levels, most of the people in the middle three severity categories estimated their risk as one category less severe

than the professionals did.” The main areas of risk underestimation involved factors close to the home, like distance to dense, overgrown vegetation, and the combustible nature of a building’s exterior. Since the previous surveys in Larimer and Boulder Counties suggest that people who perceive higher risk perform more mitigation, it follows that those who underestimate will do less, with potentially harmful results. Knowing that people tend to underestimate their risk suggests that more needs to be done to educate and help homeowners overcome the barriers to effective mitigation.

#### **A GROWING AWARENESS**

Patty Champ and Hannah Brenkert-Smith have gotten the word out about their research results through radio interviews, popular articles, and presentations to community leaders, but one of the main avenues has been direct interactions with homeowners. As

***“Across the five levels, most of the people in the middle three severity categories estimated their risk as one category less severe than the professionals did,” says researcher Hannah Brenkert-Smith.***

Patty explains, “The people who need the information are actually part of the research project. We’ve sat at the table with them, and their input and concerns have helped shape the questions. At the same time, their participation leads to increased awareness of these issues.” After performing these studies, the researchers are in a good position to start to answer the question—are homeowners getting

the message? Yes, they say, but first the bad news: since the WUI continues to grow in size and population, it is inevitable that more lives and properties are at risk in any given fire season. But there are reasons to be optimistic. Patty Champ believes that the recent spate of devastating wildfires in the West has changed the conversation: “People are now saying that we need to plan for wildfire at multiple levels. Education programs are not enough; we also need regulations and HOA covenants.” There are signs that communities are starting to rouse to the problem and respond. A sampling of recent regulatory changes in Colorado includes the following:

- Boulder County amended its building code (effective January 1, 2013) to require that buildings in defined fire-prone areas are built with fire-resistant materials.
- Colorado Springs amended its fire code (as of December 5, 2012) to require mitigation in the WUI, including smoke alarms, sprinkler systems, fire-resistant construction materials, and fuels management (some apply only to new construction).

Another reason for optimism is that over the past decade, communities seem to be awakening to the need for wildfire mitigation. For example, in the recent past it was common to find covenants in place that required architectural committees to approve removal of trees in WUI neighborhoods, according to Hannah Brenkert-Smith, which would be a barrier to mitigation action. She observed that since then, “Although we have not researched this specifically, it seems to have become much more likely that an HOA in the WUI will encourage and facilitate vegetation reduction.” Also, the infamous Hayman



*Many property owners enjoy the scenic views offered by ridgetop locations and nearby forest vegetation, but these are major risk factors that become a liability during wildfire. (Photo credit: Rocky Mountain Research Station)*

Fire that burned near Denver in 2002 catalyzed the passing of the Healthy Forests Restoration Act (HFRA) in 2003, which provides funding and guidance for better forest management practices throughout wildland areas and the WUI. One of the key outcomes of the HFRA was to provide incentives (e.g.,

mitigation cost-sharing) for communities to reduce fuels, and support to create Community Wildfire Protection Plans (CWPPs), which represent an organized, community-level effort to evaluate conditions and develop plans among property owners, local government, local fire authorities, and the state forest

### KEY FINDINGS

- Informal social networks (e.g., talking amongst neighbors) were more important than institutional arrangements (e.g., insurance mandates) in terms of promoting firewise mitigation actions.
- Wildfire information received from local volunteer fire departments, county wildfire specialists, and neighbors was also positively related to higher mitigation levels.
- Experiencing a major wildfire in the area raised the level of concern of WUI residents for their health and property compared to pre-fire levels.
- WUI residents tend to underestimate their levels of wildfire risk when their self-assessment is compared to an assessment by a professional.

service to manage wildfire risk. It remains to be seen whether CWPPs are effective tools for improving mitigation levels, but clearly they are part of a growing trend towards homeowner awareness and cooperative fire risk-reduction. According to Hannah Brenkert-Smith, “Over the past decade, there has been an important cultural shift towards reducing fuels to mitigate wildfire risk in the wildland-urban interface.” This increase in awareness and action will be a

critical factor in offsetting WUI losses as more and more houses are built in these flammable landscapes. In the long term, it is possible that this kind of education and outreach will play a role in moving homeowners to better understand the ongoing risk that wildfire poses in the WUI so they can adapt and learn to live with wildfire.

## MANAGEMENT IMPLICATIONS

- The strong influence of informal social networks (talking with a neighbor about wildfire) could be used to move homeowners to higher levels of risk mitigation. Given the budget constraints associated with most formal wildfire education programs, use of informal social networks may be a very promising approach to overall risk reduction.
- Homeowners value mitigation advice and guidance that is specific to their property, which suggests that site visits by professionals may help to increase mitigation action and that this may be a good place to concentrate funding.
- The fact that homeowners underestimate their risk with respect to building materials and vegetation suggests that they would benefit from increased efforts to educate them on what “firewise” home sites look like. One way to do this would be setting up community demonstration areas.

## FURTHER READING

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