

FINAL REPORT

Is the whole greater than the sum of its parts?
Homeowner wildfire risk mitigation, community
heterogeneity, and fire adaptedness.

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Abbreviations/Acronyms:

CWPP	Community Wildfire Protection Plan
FSC	FireWise Southwest Colorado
WRWC	West Region Wildfire Council
WUI	Wildland Urban Interface

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community variation; Fire Adapted Communities; fire adaptedness; quantitative analysis; wildfire; wildland-urban interface; neighbor effects; spatial spillovers; wildfire; defensible space; parcel risk assessments; risk preferences

Abstract

In this project we posed the question “Is the whole greater than the sum of its parts?” We focused on homeowner wildfire risk mitigation, community heterogeneity, and fire adaptedness. One of the unique aspects of this project was that the team was a research and practice collaboration. This collaboration facilitated conceptualization and implementation of the project with an eye toward scholarly contributions as well as direct contributions to enhance the programs administered by the practitioner collaborators. This report highlights the major findings and projects. What this report is not able to capture are the many ways in which this project affected the team members. This project was the start of something much bigger – an ongoing research-practitioner team (the WiRē team) and a commitment to help other communities use social science to tailor their wildfire adaptation efforts to the local context (www.wildfireresearchcenter.org).

The first question we examined was “What is fire adaptedness?” Across participants at these differing scales, fire adaptation was described in various, related ways. In general, we found that study participants conceptualized fire adaptation in similar ways. There was agreement around the notion of fire adaptation as ongoing and context-specific. However, differences among the stakeholders emerged in translating the concept of fire adaptation into on the ground programs and activities. The scale of the respondents’ wildfire management realm (national vs regional vs local) seemed to be related to differing notions of how the fire adaptedness is implemented that we found stakeholders at differing scales of wildfire management.

The results of the inquiry into fire adaptedness informed our investigation of how individual and community characteristics relate to fire adaptedness. Using paired parcel level wildfire risk assessments and social surveys from 66 communities (2,180 individuals) in western Colorado, we found that even for variables with relatively high proportion of variation at community level, the vast majority of differences are across individuals within the community, rather than from one community to the next. This result underscores the importance of individual-level decisions.

We also found evidence of a gap between risk perceptions of WUI residents and wildfire professionals. We found that, on average, residents underestimated the overall risk of their property. We also looked at the effect neighbors have on each other with respect to wildfire mitigation. One third of the study participants reported having a neighbor that they think is increasing their risk. Perceived likelihood of fire reaching the property and causing damages was positively correlated with perceiving a neighbor is not taking action. However, we did not find those risk perceptions to be correlated with observable changes in defensible space. The only consistent predictor of defensible space that we found in this analysis was the level of defensible space on neighboring properties. Our results suggest that programs that are effective in getting single homeowners to mitigate risk may have benefits that spillover to neighboring properties. We also examined whether risk tolerant individuals were more or less likely to implement the wildfire mitigation recommendations of local wildfire educators. We found that risk neutral/tolerant individuals lived on parcels that were rated by the professional as having less defensible space and more ignitable structure materials.

This report also details innovative ways in which the research results were used to modify wildfire education programs.

Objectives and Background

The increased devastation associated with wildfires over the last 30 years in western North America has been attributed to climate change, a history of wildfire suppression, and development in fire prone areas referred to as the wildland-urban interface (WUI) (Schoennagel et al., 2017). As the number of acres and homes burned has increased, so has cost of suppressing wildfires (Rasker 2015). Adaptation to a fire-prone landscape requires more than understanding the nature of the risk. Adaptation requires action. Programs and policies with the end goal of improving community fire-adaptedness look to move WUI homeowners to understand and mitigate wildfire risk on their properties. A community cannot be fire adapted if residents do not take action to mitigate risk on their parcels. While the mitigation by community residents may not be sufficient by itself to significantly reduce community or landscape level wildfire risk, it is necessary. Therefore community wildfire education programs work with homeowners to improve the survivability of their homes by encouraging homeowners to create and maintain “defensible space” near the home and “hardening” the home through ignition-resistant building materials. The behavioral responses to such messages differ among homeowners within and across communities. A holistic examination of the concept of fire adaptation plays out within and across communities has been elusive.

The project team was a research-practitioner collaboration that leverage and expanded upon existing efforts to take a close look at what fire adaptation means to stakeholders at different scales of the fire management, to sort out the role of individual and community heterogeneity to understand measures of fire adaptedness, and to understand how local wildfire education programs can encourage wildfire mitigation behavior by community residents. We investigated these three topics with an eye toward scholarly contributions to fire science as well as practical contributions to local programs. The proposal identified three specific research questions: What is fire adaptedness? How do individual and community characteristics relate to the indicators of fire adaptedness? And What are the impacts of programs intended to affect communities' fire adaptedness on mitigation efforts by residents?

Materials and Methods

The data analyzed as part of this project came from the following sources.

Qualitative Data

Qualitative data were collected to address research question 1. Interviews were designed to shed light on how fire adaptation is understood and described by individuals who were engaged in wildfire risk reduction efforts at three levels: as community leaders and as regional leaders in southwest Colorado, and as national leaders in formal fire adaptation efforts. Brenkert-Smith et al (2107, p.15) describe the qualitative data collection process:

Indepth interviews were conducted with 25 purposively selected participants who represented the three stakeholder scales. Purposive sampling of interview participants is a nonprobability technique in qualitative research (LeCompte and Preissle 1993, Patton 2002) that seeks to select participants who have the types of information, expertise, and

experience that directly relate to the research endeavor. In this case, participants were selected based on the roles they played in efforts that seek to reduce societal risks associated with wildfire; moreover, their involvement with, and proximity to, formal fire adaptation was situated on a continuum. This continuum ranged from those who played key roles in articulating and promoting fire adaptation at a national level to those who were engaged with community members within their own neighborhoods or fire districts.

The first group was comprised of individuals ($n = 8$) who were actively engaged in national-level leadership efforts with the Fire Adapted Communities (FAC) Coalition and were identified through their formal affiliation with FAC. These individuals contribute to the development of the programmatic dimensions of efforts that support and promote fire adaptation in at-risk communities. In addition to being members of the Fire Adapted Communities Coalition and FAC Learning Network, the participants in this group also represented a range of institutions (from federal agencies to community organizations) for which supporting fire adaptation is a goal. Agencies represented by study participants included the North American Fire Learning Network, the International Association of Fire Chiefs, the Watershed Research and Training Center, The Nature Conservancy, the Institute for Business and Home Safety, the U. S. Forest Service, and the National Fire Protection Agency. In other words, these participants were formally linked to large, federal agencies and NGOs that articulate and create programs to carry out policy trajectories in a range of different wildfire related sectors.

The second group was comprised of individuals ($n = 6$) who played a role in regional leadership through their positions with one of two regional organizations that seek to reduce wildfire risk in western Colorado: WRWC and FSC. These regional organizations were selected because they both have a history of working on wildfire issues and experience with fire adaptation efforts. However, the two organizations differ in their histories and in many of the specific approaches and programs they offer. Both organizations are part of a larger research effort. The participants were identified based on the key programmatic roles they played in developing and implementing wildfire education and outreach programs and engaging in and supporting wildfire risk reduction activities.

The third group was comprised of individuals ($n = 10$) who played a role in community leadership in the areas served by the regional organizations. The WRWC participants included fire chiefs or assistant chiefs who supported and liaised with the council to promote risk reduction within their protection districts. The FSC participants included neighborhood ambassadors who focused on education and outreach efforts to promote risk reduction activities within their communities. This group of participants engaged with community members most closely; they were members of the communities in which they worked, and sat at the intersection of programmatic efforts developed at the national, regional, and local levels and the communities targeted for education efforts, wildfire mitigation cost-sharing opportunities, and other efforts that seek to reduce risk and increase the capacity to adapt and resilience. These participants were purposively selected from lists of local leaders that were provided by WRWC and FSC based on the types of communities and fire districts in order to ensure that a variety of contexts was

represented. Inperson interviews were conducted whenever possible (n = 18), and over the phone (n = 7), as needed. All interviews were conducted by the same researcher and were guided by the one interview protocol to ensure that each interview covered the major topic areas and to increase comparability across interviews. All interviews were recorded and contextual notes were taken during the interview.

Quantitative Data

We built on the existing “Living with Wildfire in Colorado” project, an interagency collaboration involving the US Forest Service, Rocky Mountain Research Station; the University of Colorado, Institute of Behavioral Science; the Bureau of Land Management Southwest District Fire Management and the West Region Wildfire Council (WRWC). The funded research expanded the current project to also include FireWise of Southwest Colorado (FSC) communities. The WRWC and FSC are wildfire mitigation and education councils in Colorado tasked with encouraging homeowners to mitigate their wildfire risk. The WRWC covers six Colorado counties (Delta, Gunnison, Hinsdale, Montrose, Ouray, and San Miguel) while FSC covers five Colorado counties (Archuleta, Dolores, La Plata, Montezuma and San Juan). The project paired parcel level wildfire risk assessments with social data in six counties (Delta, Ouray, San Miguel, Archuleta, La Plata and Montezuma) in western Colorado. The social surveys were conducted and funded by the respective wildfire councils. This project funded the collection of some of the parcel level risk data and the analyses of those data paired with the social survey data. Table 1, summarizes the data used in this report. The various data analyses described below often used subsets of the entire data set described in Table 1.

Table 1: Project Data

	West Region Wildfire Council Counties			FireWise Southwest Colorado Counties		
County:	Delta	Ouray	San Miguel	Archuleta	La Plata	Montezuma
Number of Completed Parcel Risk Assessments	1921	602	1928	703	913	481
Number of Completed Surveys	681	291	713	209	345	186

WRWC and FSC develop and implement science-informed wildfire risk programs. As part of this effort, the Councils collect data on all developed residential parcels in selected communities within their territories, where a parcel's community is determined by its location relative to community boundaries established in county-level CWPPs. Data for this study come from multiple efforts replicating the same methods: Log Hill Fire Protection District (Ouray County) (2012), Delta County (2013), Telluride FPD (San Miguel County) (2014-2015), and Archuleta, La Plata, and Montezuma Counties (2015-2016). These data include both a rapid assessment and a resident survey.

The rapid assessment (Figure 1) is based on the Home Ignition Zone concept (Cohen 2000) and has been developed by the Bureau of Land Management and WRWC over a series of implementations. A specialist assesses parcels for 11 characteristics that affect the risk of wildfire to the home. WRWC and FSC also administered resident surveys to all parcels within communities with completed rapid assessments, using mailing addresses from County Assessor records. The surveys elicit responses on many dimensions of residents' relationships with wildfire, plus personal and property characteristics, as detailed below. Response rates, adjusted for non-deliverable surveys, vary from approximately 30% in Archuleta County to 62% in LHFDPD. Technical reports provide more information and detailed results from the rapid assessments and resident surveys (Meldrum et al. 2017, 2015, 2013; Meldrum et al. in production; and Brenkert-Smith et al. in production).

In addition, the wildfire councils provided data on community characteristics. We studied a set of 66 communities within territory served by WRWC and FSC. We relied on community boundaries defined in each respective counties' Community Wildfire Protection Plan (CWPP). Included communities span six counties. These counties and communities differ in many ways, including wildfire hazards, fire protection and related capacities, and wildfire education and outreach. The Councils selected these communities for study based on their identification as facing significant wildfire hazards in the CWPPs.

WRWC's Rapid Wildfire Risk Assessment

ACCESS

Structure address posted at driveway entrance?

Posted and reflective	0
Posted, NOT reflective	5
Not Visible from road	15

Ingress and egress

Two or more roads in/out	0
One road in/out	10

Width of driveway

Greater than 24 feet wide	0
Between 20-24 feet wide	5
Less than 20 feet wide	10

STRUCTURE

Roofing material

Tile, metal, asphalt	0
Wood (shake shingle)	200

Building exterior

Non-combustible siding (stucco,	0
Log, heavy timbers	20
Wood, vinyl, or wood shake	60

Location of woodpiles and combustibles (light flashy veg., shrubs, trees, trash)

None or > 30 ft from structure	0
10-30 feet from structure	10
< 10 feet from structure	30

Balcony, deck, or porch

None	0
Non-Combustible Deck/Fence attached to Structure	20
Combustible Deck/Fence attached to Structure	50

25-150	LOW
151-175	MODERATE
176-270	HIGH
271-365	V. HIGH
366-665	EXTREME

VEGETATION & TOPOGRAPHY

Slope

Less than 20%	0
Between 20% and 45%	20
Greater than 45%	40

Distance to dangerous topography

More than 150 feet	0
50-150 feet	30
Less than 50 feet	75

Predominant background fuel type in neighborhood

Light (grasses, forbs, tundra)	25
Moderate (light brush, small trees)	50
Heavy (dense brush or timber, down and dead fuel)	75

Defensible space (CSFS 6.302 Standards)

More than 150 feet	0
30-150 feet	50
10-30 feet	75
Less than 10 feet	100

Figure 1: WRWC rapid wildfire risk assessment

Results and Discussion

Research Question 1: What is fire adaptedness?

The first research question we investigated is how stakeholders involved with wildfire management define and understand “fire adaptedness”. The results of this qualitative inquiry are fully described in (Brenkert-Smith et al. 2017). As articulated in Brenkert-Smith et al. (2017, p. 7) this inquiry started with the premise that “Creating fire-adapted communities requires efforts beyond the development of policy and programs. Adaptation in fire-prone communities requires development of insights into what adaptation means to communities at risk, what it means for communities to adapt to fire, how one might recognize a community is fire adapted or on the path toward adaptation, and what kinds of social processes support such efforts.” Qualitative interviews were conducted with stakeholders that are engaged with fire management at national, regional, and local scales. Across participants at these differing scales, fire adaptation was described in various, related ways. In general, we found that study participants conceptualized fire adaptation in similar ways. There was agreement around the notion of fire adaptation as ongoing and context-specific. However, differences among the stakeholders emerged in translating the concept of fire adaptation into on the ground programs and activities. The scale of the respondents’ wildfire management realm (national vs regional vs local) seemed to be related to differing notions of how the fire adaptedness is implemented. Brenkert-Smith et al. (2001, p. 10) conclude:

Indeed, at the conceptual level, adaptation appears to provide a way to pull together and bridge multiple sectors at work at multiple scales in the wildfire dilemma. Whether or not the concept is similarly meaningful at the levels of the regional and community leadership included in this study is a critical question, as such stakeholders could play important roles in the transition of language, public understandings, and programs needed to support such efforts. Shared understanding of, and investment in, the notion of adaptation across stakeholder groups is particularly important because, as adaptation is described here, efforts require the active involvement of stakeholders at multiple social scales. Indeed, at its very core, adaptation is described to rely upon the interconnectedness of sectors at work to address the unintended consequences of past approaches in order to lay out a path that rights those missteps and seeks a more sustainable future. And yet, it appears that gaps exist between the efforts to characterize, define, and set programs in place to support adaptation and the stakeholders who focus on the spaces onto which adaptive practices are to be implemented. These gaps seem to reflect where study respondents sit in relation to the scope of the mandates and responsibilities of their positions. Importantly, however, data from those interviews do not indicate that these gaps are insurmountable, but rather that these gaps, if identified and addressed, may be seen as opportunities..... Like adaptation research related to climate change, we see that participants largely share the view that adaptation must occur based on local experience and contextual knowledge (Vedwan and Rhaodes 2001, Thomas et al. 2007, Adger et al. 2009). Indeed, this tenet was articulated by all participants. And yet, we also see that participants who are a part of community leadership, those most keenly aware of these contextual characteristics and differences,

are the most likely to place value on tools (i.e., checklists) to help translate the concept of adaptation to specific, measurable, and locally relevant community goals. What is perhaps lost when regional or national leaders object to indications that checklists are valuable to the work of local leadership is the importance of the contributions of local leadership in identifying and articulating local capacity and the need to engage in adaptation efforts. Processes that can engage this tension can facilitate adaptive thinking or planning and build local capacities needed for ongoing adaptation efforts. In other words, the promotion of the concept of adaptation, when bolstered by support of local processes that translate the conceptual to the practical, may imbue the applied with local knowledge and contextual nuance and serve to bridge conceptual to implementation, national to regional to local leadership, and spur action at multiple social scales.

The results of this qualitative inquiry shaped our approach and considerations when investigating the research questions described in the next two sections. In particular, the interviews with local wildfire management stakeholders suggested the parcel level wildfire risk, resident attitudes and expectations related to wildfire suppression may reflect where residents are on the fire adaptation path.

Research Question 2: How do individual and community characteristics relate to the indicators of fire adaptedness?

We outlined three tasks related to this research question. We describe the results of the broader inquiry by summarizing the research results related to each task.

Task 1: Examine the relationships among indicators of fire adaptedness, aggregated individual level characteristics, and other community characteristics.

In this task we used paired wildfire risk assessment and social data from both FSC and WRWC communities. Data came from n=2,180 survey respondents and cover 36% of the N=6,012 assessed parcels in the communities of interest. We omitted results from communities with fewer than five survey respondents, leaving a total of 66 communities with an average of 32 respondents each. The summary below has largely been taken from a draft manuscript (Meldrum et al. *in review*) that took a thorough look at the notions of wildland-urban interface residents' in our study communities to parse out variation within and across communities.

Broadly, results demonstrated that: a) all considered measures show substantial variation across responses, b) the majority of this variation occurs at the individual level for all variables, and yet c) a substantial amount of variation also occurs at the community-level for many variables. In other words, our results showed how certain aspects of the relationship of WUI residents with wildfire differ both *within* and *across* communities. Our analysis suggests that some wildfire social science results will be relatively consistent across communities, whereas others will not, and the study contributes evidence to broader efforts for understanding which is which.

Specifically, we investigated 39 separate measures of aspects of the relationship between WUI homeowners and their wildfire risk, addressing: property characteristics, agreement with attitude statements relevant to wildfire risk, expected outcomes of wildfire, sources of information about wildfire, preparation for and mitigation of wildfire risks, and barriers to reducing wildfire risk. We use hierarchical modeling to describe the allocation of observed variation in each of these

measures across three different levels: the individual, the community, and the county. In the manuscript under review and in the brief summary below, we focused on the variance partition coefficient (VPC), which reflects the percentage of variation in response attributable to each level in the multi-level model.

Much of the fire social science literature finds a role for attitudes in influencing decisions about wildfire risk on private land parcels. We examined a battery of such measures (see table below) that address social factors noted in the literature as potentially relevant. We found that most respondents agree that wildfire is natural, but they also prioritize saving homes over forests. Responses were mixed on whether it is possible to control wildfires once started. Most respondents disagree with various potential attitudinal reasons they might not mitigate their risk, such as a perceived lack of effectiveness, it being the government's responsibility, or a concern for visual impacts. That said, results showed substantial variation in agreement, with at most 83% falling into any one category – even after collapsing to three response categories. Further, statistical analyses demonstrated that for all attitude measures, most of this variation in response comes from *within* communities, i.e. across individuals. This means that the distribution of attitudinal viewpoints within a community did not meaningfully change across different communities within our study.

Table 2: Agreement with attitude statements and variance partition coefficients (VPC)

<u>Statement</u>	<u>Response by category</u>			<u>VPC by level</u>		
	Disagree	Neutral	Agree	county	comm-unity	individ-ual
Wildfires are a natural part of the balance of a healthy forest/ecosystem.	5%	12%	83%	0%	1%	99%
During a wildfire, saving homes should be a priority over saving forests.	8%	20%	72%	1%	0%	99%
With proper technology, we can control most wildfires after they have started.	41%	30%	28%	0%	2%	98%
You don't take action because adjacent properties are not treated leaving your actions ineffective.	73%	21%	6%	3%	1%	96%
You live here for the trees and will not remove any of them to reduce wildfire risk.	77%	16%	7%	2%	3%	96%
Managing the wildfire risk is primarily a government responsibility.	79%	16%	5%	4%	1%	95%
Actions taken by homeowners to reduce the risk of loss due to wildfire are not effective.	83%	11%	6%	1%	2%	97%

Note: "strongly (dis)agree" and "(dis)agree" collapsed to "(dis)agree" for concise display.

Because risk is a function of the probability of an event and the consequences if that event occurs, risk perceptions are in part a function of perceived consequences. Thus, questions about expected outcomes of a wildfire on residents' property provide insight into their risk perceptions. The following table presents respondents' perceived likelihood of different potential outcomes of a wildfire on their property, reported on a scale from 1 (not likely) to 5 (very likely). Responses varied substantially across the sample, with at most 66% of respondents and at least 14% of

respondents in any one (collapsed) category. In general, respondents saw landscape burning, fire department saving their homes, and spread of the fire to nearby public lands as more likely, whereas they saw themselves putting the fire out and community water supplies being threatened as less likely. Although most variation occurred at the individual level, VPC estimates show significant levels of variation across communities for many variables, namely those about the fire department, nearby public lands, and damage to homes.

Table 3: Perceived likelihood of effects of wildfire on property and variance partition coefficients (VPC)

<u>Effect of wildfire on property</u>	<u>Response by category</u>				<u>VPC by level</u>		
	Not Likely		Very Likely	n/a	county	community	individual
	1-2	3	4-5				
Your trees and landscape would burn.	15%	19%	66%	1%	2%	3%	94%
The fire department would save your home.	21%	23%	56%	1%	1%	14%	85%
The fire would spread to nearby public lands.	27%	19%	54%	5%	3%	8%	88%
There would be some physical damage to your home.	24%	27%	49%	1%	4%	6%	90%
Your neighbors' homes would be damaged or destroyed.	27%	28%	45%	2%	0%	8%	92%
Your community water supply would be threatened.	57%	14%	30%	9%	1%	2%	97%
You would put the fire out.	58%	18%	24%	1%	1%	3%	96%

Note: Ratings "1" and "2" collapsed to "1-2," and "4" and "5" to "4-5"; VPC calculated with "n/a" category omitted.

While more than half of respondents reported having discussed wildfire with neighbors, fewer than half reported any given source of information. More common sources tended to be local, such as the fire department or wildfire Council, whereas state, federal, or general websites were least commonly reported. Despite most variation occurring across individuals, meaningful amounts of variation also occurred at the county and/or the community levels for all variables pertaining to information sources except the general media. In particular, the county level was important for getting information from wildfire Councils, neighbors (organized or not), and wildfire-related websites, and the community level was important for all except the media, wildfire-related websites, and neighbors, friends, or family members. Finally, whether respondents reported receiving no information about wildfire varied strongly at the county and individual levels.

Table 4: Reported sources of information about wildfire and variance partition coefficients (VPC)

	<u>% yes</u>	county	<u>VPC by level</u>	
			comm-unity	individ-ual
Have you ever talked with a neighbor about wildfire issues?	55%	13%	8%	79%
Have you received information about wildfire from:				
Local fire department	43%	1%	12%	88%
Wildfire Council	43%	16%	5%	79%
Neighborhood group (homeowners group, neighborhood watch, etc.)	33%	28%	17%	55%
Media (newspaper, TV, radio, internet)	32%	0%	2%	98%
Neighbors, friends, or family members	27%	8%	4%	88%
Colorado State Forest Service	18%	3%	7%	90%
US Bureau of Land Management or US Forest Service	15%	0%	6%	94%
A wildfire-related website	10%	8%	1%	91%
None of the above. You have not received any information about wildfire	14%	13%	3%	84%

The following table presents measures of stated collaboration with neighbors on reducing risk, reported planning for evacuation, and observable defensible space (in terms of vegetation as well as other combustible items, such as woodpiles, propane tanks, and patio furniture). Consistent with above, responses ranged across all categories, and the majority of the variation was attributable to the individual level. However, all four measures also varied meaningfully across communities, and all but evacuation planning varied substantially across different counties in the study.

Table 5: Reported and observed preparation and mitigation, and variance partition coefficients (VPC)

<u>Question</u>	<u>% yes</u>	county	<u>VPC by level</u>	
			comm-unity	individ-ual
Have you worked with any neighbors to reduce the risk of wildfire?	25%	8%	9%	83%
Do you have an evacuation plan in the event of a wildfire?	59%	2%	5%	93%
<u>Characteristic</u>	<u>Categories and percent in each</u>			
Distance from home to overgrown, dense, or unmaintained vegetation	> 150 ft. 10%	30 to 150 ft. 25%	10 to 30 ft. 38%	< 10 ft. 27%
Distance from home to other combustible items (e.g. firewood, propane tanks)	None or > 30 ft. 31%	10 to 30 ft. 29%	< 10 ft. 40%	41% 8% 51%

Finally, Table 6 reports on respondents' agreement with different possible reasons for not reducing wildfire risk on their property, and in contrast to the preceding table, nearly all of the variation in most responses occurred at the individual level. Not surprisingly, restrictions by homeowners associations is a strong exception, with nearly half of variation coming from the county and the community levels. Lack of information about or options for slash removal also varied meaningfully at the community level. In contrast, nearly all variation in barriers from physical difficulties, financial costs, time limitations, perceived lack of effectiveness, and a desire to not change property looks occurred at the individual level. In other words, one would expect similar percentage of "yes" responses to these variables across different communities or counties in our study area.

Table 6: Reported factors keeping respondents from reducing wildfire risk on their properties and variance partition coefficients (VPC)

<u>Factor for not reducing wildfire risk on property</u>	<u>% yes</u>	<u>VPC by level</u>		
		county	comm-unity	individ-ual
Physical difficulty of doing the work	36%	1%	2%	98%
Financial expense/cost	31%	1%	4%	95%
Lack of information about or options for removal of materials from thinning vegetation	28%	2%	5%	93%
Lack of specific information on how to reduce wildfire risk on your property	27%	6%	3%	91%
Time it takes to do the work	26%	0%	3%	97%
Do not want to change the way your property looks	21%	0%	2%	98%
Restrictions by homeowners' association on cutting trees	17%	20%	27%	53%
Lack of effectiveness of risk reduction actions	15%	1%	2%	96%
Lack of awareness of wildfire risk	13%	8%	4%	88%

Overall, remembering that even nominally small percentages of variation attributed to the community or county levels (i.e. approximately 5% or more) correspond to meaningful differences across communities, we found substantial variation *across* communities in some key variables, especially those relating to from where WUI residents get information about wildfire, what they expect to happen in the event of a wildfire, and measures of their level of preparation and mitigation. For example, we found that observed levels of mitigation vary systematically across communities. However, the variation in barriers to conducting mitigation was typically found across individuals, rather than across different communities, with important exceptions relating to areas that can be targeted by local institutions of wildfire programs. Although we cannot speak to the source of this community-level variation or to directions of causality at this point, our results suggest that it would be useful to identify which communities face these barriers when developing programs aimed at reducing wildfire risks. Similarly, expectations regarding whether the fire department would save one's home or whether that home would be damaged in the event of a wildfire on the property vary across communities. Indeed, the likelihood of these events does vary in reality, with communities having different levels of protection, response capacity, and mitigation; it remains an open question beyond the scope of this paper how these variations might interact with each other and with other individual-level

considerations.

Overall, although not directly contradictory to the finding that "social science studies that included multiple study sites often found that there were more similarities than dissimilarities between sites" (McCaffrey et al 2013, p. B), our results from this task suggest a strong need for caution in generalizing from studies in different places and communities, as consistent with the National Cohesive Wildland Fire Management Strategy: "[t]here is no one-size-fits-all solution to reducing wildfire risk. Solutions must be tailored to landscapes and communities¹" (p. 2). They also suggest that assumptions of independent, identically-distributed errors, which are essential to many basic quantitative analyses, might often be violated if datasets pool across different communities or contexts. As this can have profound implications for statistical inference, our results suggest a strong need for caution in conducting multi-location statistical analyses. Similarly, the results demonstrate the value of community-level analysis and efforts to understand the role of community contexts in explaining WUI residents' relationships with wildfire, such as case study comparisons (e.g., Gordon et al. 2012, Stidham et al. 2014, McLennan et al. 2015). In particular, we find large variation across communities in terms of residents' sources for information about wildfire risk.

These results underscore the fact that communities are made up of individuals who tend to have a wide array of relationships with wildfire. For some aspects of this relationship, most notably attitudes regarding wildfire and its suppression, patterns of response appear consistent across a large set of diverse communities. For many other aspects, however, the distribution of people's relationships with wildfire change across different communities.

This tasks' results also demonstrate that individual context matters for all considered measures. Indeed, for every evaluated variable, a non-negligible portion of responses do not match the majority response, and the dominant level of variation in responses is across individuals rather than across communities. Although not surprising, this result highlights the importance of considering the coverage of research findings across an entire community, let alone from one community to the next. As such, this study suggests benefits from collecting original data, specific to a community of interest.

Task 2: Examine, across communities, the wildfire "risk perception gap," i.e., the hypothesized disparities between wildfire assessments by residents and those by professional wildfire risk assessors.

Homes in the WUI generally have less defensible space than wildfire professionals would like. That does not in itself mean that levels of defensible space are less than optimal from the standpoint of the decision makers (the homeowners). Rapid growth in the WUI suggests people are willing to purchase homes in high risk areas. If homeowners are indeed satisfied with defensible space levels, any policy to affect mitigation levels on private lands would have to convince residents that they misunderstood their risk, convince residents that they misunderstood potential damages, or change the incentives residents face. Generally, these policies assume a "risk perception gap" exists between the public and the professional firefighting community.

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<https://www.forestsandrangelands.gov/strategy/documents/strategy/communications/NationalCSWFMSbrochure.pdf>

We examined whether a risk gap exists and dig more deeply into the nature of the risk gap. We approached this task using paired parcel wildfire risk assessment and social data collected by West Region Wildfire Council prior to the JFSP funding. The JFSP funding leveraged the data collection and allowed team members to work on and present results of Meldrum et al.(2015) in the context of the larger JFSP funded project. Consistent with research from a variety of domains, we found evidence of a gap between risk perceptions of WUI residents and wildfire professionals. Specifically, on average, residents underestimated the overall risk of their property. The nature of the data allowed us to take a closer look at risk by examining individual property attributes related to wildfire risk, including the flammability of the home’s exterior and deck, the distance to flammable vegetation and other combustibles, and the visibility of the property’s address. “However, differences in attribute ratings were nuanced, with the level of background fuels and width of driveway typically placed in more risky categories by residents than the professional. These differences demonstrate that residents and the professional disagree on both subjective and objective aspects of risk even when considering seemingly straightforward, individual property attributes, but the direction of that disagreement is not consistent across measures. Assessing many of these attributes involves some level of judgment, and therefore subjectivity, such as what counts as “overgrown, dense, or unmaintained vegetation” or “dangerous topography.” For such attributes, the professional can be expected to have a privileged perspective due to an advanced understanding of wildfire behavior and the vulnerabilities of a structure to wildfire, suggesting opportunities for education to improve residents’ understanding of the details of factors that contribute to wildfire risks. For example, a resident might call a sign reflective if he used reflective paint on the sign, but a wildfire professional would only judge that sign as reflective if she expects it to be easily visible in heavy smoke conditions, which can be influenced by positioning, cleanliness, and obstructions. At the same time, differences in resident and professional risk assessments of more objective attributes such as the width of a driveway or the distance to combustible objects suggest that differences between residents and the professional’s risk perceptions also stem—in part—from inaccuracies in judging distances. In addition, our results suggest that residents and the professional differ in how they implicitly weight these attributes when assessing overall wildfire risk. These results demonstrate the complexity of the disconnect between residents’ and the professional’s wildfire risk perceptions, one grounded in perhaps differences in perspective and knowledge as well as expertise in relevant skills, such as judging distances. Corroborating the complexity story, many potentially explanatory variables do not help explain the presence or direction of the observed risk perception gap...” (Meldrum et al. 2015, p. 13).

Table 7 below summarizes the main evidence of the risk gap across the entire available dataset. The first two rows depict all assessed properties and all assessed properties with survey responses, respectively, with percentages pertaining to the proportion of properties in each row that were assigned to each objective overall risk rating by the professionals' rapid wildfire risk assessment. The close similarity of the distribution across the rows provides evidence to support the representativeness of survey responses with respect to the critical dimension of assessed risk levels. The final five rows depict the percentage of properties within each professional's categorical rating that were self-assessed by survey respondents as each category; columns sum to 100% over these five rows. Close correspondence between the residents' and professionals' ratings would manifest as the bulk of responses going along the diagonal from the top-left to bottom-right, but no such pattern is demonstrated. Rather, the majority of respondents rate their

own property as Moderate, and few rate their own property as either Very High or Extreme risk, regardless of the professional's assessment of that property.

Table 7: Risk Gap

	n	Professional's categorical rating				
		Low	Moderate	High	Very High	Extreme
All properties	6,936	13%	6%	31%	32%	19%
All properties with survey responses	2,285	12%	6%	33%	31%	18%
Survey rating: Low	459	44%	19%	22%	14%	14%
Survey rating: Moderate	1,185	45%	50%	53%	53%	57%
Survey rating: High	485	9%	25%	19%	27%	24%
Survey rating: Very High	94	1%	3%	4%	5%	5%
Survey rating: Extreme	21	0%	3%	1%	0.4%	1%

In addition to the contribution to the literature, the results of the risk gap investigation provided important information that West Region Wildfire Council used to implement programs in the study community. Further, we conducted analogous analyses to that published in the associated contribution to the peer reviewed literature, but with datasets pertaining to other communities and counties, and presented these in numerous venues to stakeholders and other researchers. Specifically, the study results shaped WRWC's understanding of how residents were underestimating parcel level risk that was used to modify education efforts.

In addition to risk *perceptions*, data from two of the WRWC counties (San Miguel and Delta) were examined to investigate the question of how risk *preferences* relate to mitigation behaviors. That is, we examined whether risk tolerant individuals were more or less likely to implement the wildfire mitigation recommendations of local wildfire educators. While the question is straightforward, addressing it with the requisite data is not. One of the unique aspects of this study is that data included self-reported measures of parcel wildfire risk attributes paired with measures from a professional assessment. Much of the literature on risk preferences and risky behaviors relies on self-reported behaviors. Being able to compare the self-assessments with the professional assessments of parcel wildfire risk not only provides insights into the differences (and similarities) of the two assessments, but also how covariates, such as risk preferences and risk perceptions, are related to the two types of data. While there are significant differences between self-assessments and the professional assessments, as described above, they are correlated and the multivariate models found some similar covariate relationships. Simple analyses showed that risk-averse respondents had lower risk ratings compared to risk neutral/seeking respondents for both the self-assessment and professional assessment. Some of these differences were statistically significant. If we left the data analyses at that, we would conclude that risk preferences are related to risky behavior with risk-averse respondents living on parcels less likely to be affected by wildfire.

A more nuanced story is revealed when we controlled for other factors that have been found to be related to both wildfire risk and other natural hazards such as floods. The somewhat surprising result from this study was that risk aversion was found to be significantly correlated with better

defensible space around a home as assessed by a professional but not as self-assessed. This result has direct relevance to wildfire risk education programs. We noted that risk neutral/tolerant individuals live on parcels that are rated by the professional as having less defensible space and more ignitable structure materials. However, those same risk neutral/tolerant individuals do not self-assess their parcel as having less defensible space and more ignitable structure materials. And in this study, the majority of the survey participants (66%) were characterized as being risk-neutral/seeking. Wildfire risk education programs that focus on communication of wildfire risk in general will not likely be effective in this context. Better understanding these risk-neutral/seeking individuals and how they can be incentivized to undertake risk mitigating actions would facilitate more effective programs. Some of the other results from the multivariate analyses might provide some guidance. For example, income was found to be negatively related to both creation of defensible space and the ignitability of the structure. Cost share programs, where the cost of removing vegetation from a property is subsidized, are one tool widely used in wildfire programs to deal with income constraints. We also found that respondents reporting neighbors with dense vegetation had less defensible space themselves based on both the self-assessment and the professional assessment. This result might direct a programmatic approach that encompasses “neighbors” rather than individual landowners.

Another notable result from this study was the relationship between risk perception and defensible space. For both the self-assessment and the professional assessment, respondents that perceive a higher probability of a fire starting and threatening their property were assessed to have higher overall parcel risk ratings and less defensible space. This result calls into question the simplistic notion that if education programs better communicate general wildfire risk, homeowners will respond appropriately and mitigate the risk.

Task 3: Identify spillover effects at the individual parcel level as they relate to wildfire attitudes, perceptions, and community fire adaptedness indicators.

In this task we examined paired parcel level wildfire risk assessment and social data from all of the WRWC study communities in Delta, Gunnison, Ouray and San Miguel Counties. We examined what effect fuels on neighboring lands have on the wildfire risk mitigation decisions of WUI residents. Well-maintained neighboring properties may encourage people to take action to clear vegetation on their own land, either because they believe their own actions are now more effective, because neighbors’ actions provide information on wildfire risk and possible mitigation actions, or because neighbors’ actions encourage a social norm of creating defensible space. Likewise, households may not bother to mitigate wildfire risk if neighboring lands have dense flammable vegetation. In such cases, risk mitigating actions are said to be strategic complements, and efficient levels of mitigation depend on coordinating actions. In contrast, if unmaintained neighboring properties cause households to self-protect by creating more defensible space, or if well-maintained neighboring properties cause households to become lax about clearing their own vegetation due to a lower perceived threat, risk mitigation actions are said to be strategic substitutes.

In our data, we found that properties with high background fuels and near dangerous topography were more likely to have dense vegetation around their home, compounding their risk of wildfire. In addition, one third of the study participants reported having a neighbor that they think is increasing their risk. Perceived likelihood of fire reaching the property and causing

damages go up if a neighbor is perceived as not taking action. Those risk perceptions do not necessarily lead to observable changes in defensible space. Rather, the only consistent predictor we find for levels of defensible space on a given property is the level of defensible space on neighboring properties. This finding gives further support for community level mitigation efforts. Our results show that moving homeowners to mitigate risk may have benefits that spillover from that property. Neighbors may encourage each other, and can lead to landscape level changes. It may be particularly important to target owners of properties with dense vegetation, who seem to be holding things back. Without time series data on mitigation levels, we cannot tell how quickly these social influences occur or exactly how targeting individual homeowners could aggregate to landscape level risk mitigation. Aerial photography data and the ability to analyze it, however, are becoming more and more available. We believe this is an important next step for research and that it is just a matter of time before all of the pieces for such analysis are in place.

Research Question 3: What are the impacts of programs intended to affect communities' fire adaptedness on mitigation efforts by residents?

Many of the insights described above speak to the likely impact of different types of programs that are intended to affect the fire adaptedness of communities. For example, the investigation of risk tolerance suggests potential limitations of programs discussing wildfire risk in general terms, while the 'risk gap' analysis demonstrates specific areas of information disconnects between wildfire professionals and WUI residents in the study area. Beyond the more general findings, our approach to Research Question 3 was informed by the recognition of the importance of differences across communities and programs, in terms of needs, approaches, and capabilities. Specifically, we investigated the impact of two different practitioner-driven programs, each of which is intended to increase residents' engagement with the programs through the mechanisms emphasized by their respective models of public engagement. The first of these follows from the *agency-guided* model of public engagement and accordingly is implemented by WRWC. This program involves using targeted outreach letters to encourage further interaction between homeowners and WRWC's professional staff. The second of these follows from the *homeowner-guided* model of public engagement and accordingly is implemented by FSC. This program involves using Ambassadors – volunteers from the community – to educate their neighbors and encourage them to mitigate wildfire risk on their private properties.

Through WRWC's targeted outreach program, we investigated the response to the 'nudge' letters, including the response to the specific information provided therein. To our knowledge, this study is the first application of behavioral economics-based nudges (e.g. Thaler and Sunstein 2008) to the natural hazards context. Specifically, parcels within a community were stratified by assessed risk ratings and then separated into three groups, each of which received a different information treatment. These information treatments provided different levels of social comparisons: group A was informed of their community's overall risk rating only, group B was informed of their community's rating as well as their own parcel risk rating, and group C was further informed of the average wildfire risk rating of their ten closest neighbors. All respondents, regardless of treatment, were encouraged to follow-up with WRWC for more information about their wildfire risk and what can be done about it by accessing a website providing property-specific information; this follow-through was measured as the outcome variable, response rates are presented in the table below. This experiment was modeled on that of Bernedo et al. (2014), who investigated such social norm treatments in the context of water conservation and found a small

but persistent and policy-relevant effect of the social norm treatments.

Table 8: Nudge Results

Fire Protection District	Cedaredge	Crawford	Hotchkiss	Norwood	Paonia	Telluride	Total
Response rate: Overall	17%	6%	9%	10%	7%	12%	12%
Response rate: Group A	18%	4%	8%	16%	8%	10%	13%
Response rate: Group B	15%	8%	8%	9%	7%	14%	12%
Response rate: Group C	18%	6%	11%	8%	6%	13%	12%
Number of letters sent	976	227	350	332	334	564	2,783

Three main results emerged from our analysis of response rates. First, we found that a small but significant proportion of residents responded to the nudge letter in all FPDs, regardless of which treatment group they belonged to. Notably, WRWC targeted these FPDs for inclusion in the experiment because of their histories of low levels of engagement with the organization, suggesting that the average 12% response rate has a practical significance. This suggestion is supported by an observed increase in participation in WRWC-sponsored defensible-space projects: from a total of 10 over the five preceding years to 17 in the six months following the first mailing of the nudge letter to residents of the Cedaredge FPD. Second, the evidence suggests a second letter is nearly effective in terms of encouraging new engagement as the first. WRWC sent only one letter to all residents except those in Cedaredge FPD, who received two, and the overall response rate for Cedaredge (17%) was 80% higher than the response rate for all other communities combined (10%). Further, 53% of the Cedaredge responses occurred in the two months following the first mailing and the majority of those within the first week; the remaining 46% came only after the second mailing. Third, the specific content of the nudge letter is related to response rates, suggesting the importance of that contact in encouraging residents to engage with WRWC. In particular, whereas community-level risk rating (which was provided to all three treatment groups) was not found to be significantly related to response rate, individual parcel-level rating was strongly significantly related to it – but only when the information was provided on the nudge letter (i.e. $p < 0.001$ for a Wald test of joint significance of parcel-level rating indicators in a logit model controlling for FPD and community-level risk rating for Groups B and C, combined, but $p = 0.80$ for the same for Group A). In other words, the evidence suggests that the individually-specific information of the nudge letter increased residents' interactions with the professional WRWC staff, thus supporting their *agency-guided* model of public engagement.

In contrast to WRWC's emphasis on direct engagement with individual residents, FSC's programs emphasize leveraging volunteer community-based Ambassadors for encouraging wildfire risk mitigation. Twenty-eight of the 39 communities with individual-level survey and assessment data available from FSC had an Ambassador at the time of data collection. This corresponds to 81% of the individual survey responses from FSC (1719 out of 2134 responses). We conducted multivariate analyses of numerous relevant outcome variables to determine whether the presence of an Ambassador is related to variables related to components of fire adaptedness. Specifically, we estimated a series of ordered logit models of survey and assessment data, controlling for county, seasonal residents, and numerous demographic variables, with different outcome variables pertaining to stated preparation for wildfire, access to different sources of information about wildfire, and the professional-assessed property characteristics, which include measures of mitigation as well as other risk-related characteristics.

This analysis demonstrates a positive relationship between the presence of Ambassadors and key outcome variables. For example, the indicator for having an Ambassador was significant and positively correlated with the two measures of having better defensible space: the distance from the home to unmanaged or dense vegetation and the distance between the residence and other combustible objects, such as woodpiles or flammable yard furniture. In contrast, the Ambassador indicator was not significant in models for any other characteristics in the professional's rapid risk assessment, such as the flammability of the structure's siding, the density of fuels surrounding the property, or the presence of a deck. Further, the Ambassador indicator is positive and significantly correlated with residents reporting getting information about wildfire from numerous important sources, including the local fire department, FSC itself, a neighborhood group, the Colorado State Forest Service, and either the US Forest Service or Bureau of Land Management. As the data are cross-sectional, these results cannot demonstrate causality, but they are suggestive of the effectiveness of the Ambassador program in engaging with residents and encouraging the maintenance of defensible space and interaction with important sources of information about wildfire risk.

Conclusions

This project engaged a research-practice collaboration and systematic data collection across many WUI communities in western Colorado to take a more holistic look at what it means to adapt to wildfire. We found that the concept of fire adaptedness was consistent across the scale of stakeholders in our inquiry. However, notions of how adaptation is implemented on the ground was a point of departure between those at higher scales of wildfire management and those that implement community programs. One aspect of community programs is working with residents to encourage them to mitigate risk on their properties. Consistent with research on other natural hazards, we found that WUI residents underestimate wildfire risk on their properties relative to a wildfire professional. This discrepancy can be problematic. We also found that creation of defensible space had a positive spillover effect. Further, our research found that risk averse residents had better defensible space. However, the majority of the participants in this study were NOT risk averse. Rather they were risk neutral or tolerant. These risk neutral/tolerant individuals lived on parcels that were rated by the professional as having less defensible space and more ignitable structure materials. However, those same risk neutral/tolerant individuals did not self-assess their parcel as having less defensible space and more ignitable structure materials. Thinking about these results together, we conclude that community education programs that focus on general wildfire risk might be missing an opportunity. Focusing in on risk specific to a parcel might be a more constructive way to close the gap between how residents and professional rate parcel risk. If residents have a more accurate understanding of both the nature and relative weight of hazards on their parcel, they can make better decisions about how to mitigate that risk. Risk mitigation actions, such as creating defensible space, can spillover to neighboring properties on a path to creating a fire adapted community.

The researcher-practitioner collaboration team facilitated implementation of the research results on the ground. The two wildfire councils (WRWC and FSC) have different models for engaging with residents. The “nudge” experiments with WRWC residents provided information to some residents about their specific parcel level risk rating. We found evidence that the individually-

specific information of the nudge letter increased residents' interactions with the professional WRWC staff. We also examined the ambassador model of FSC and found that presence of an ambassador in a community was correlated with residents having better defensible space and a greater chance that residents get information on wildfire from multiple sources.

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Appendix B: Completed/planned scientific publications and science delivery products

Journal Articles

Published

Meldrum, J.R., P.A. Champ, H. Brenkert-Smith, T. Warziniack, C.M. Barth, and L.C. Falk. (2015). Understanding gaps between the risk perceptions of wildland-urban interface (WUI) residents and wildfire professionals. *Risk Analysis* 35(9):1146-1761

Brenkert-Smith, J.R. Meldrum, P.A. Champ, C. Barth. (2017) Where you stand depends on where you sit: A Qualitative Inquiry into Notions of Fire Adaptation. *Ecology and Society* 22(3):7.
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In Review

Warziniack, T., P.A. Champ, J.R. Meldrum, H. Brenkert-Smith, C. Barth, L.C. Falk. Responding to risky neighbors: Testing for spatial spillover effects for defensible space in a fire-prone WUI community. *Environmental and Resource Economics*.

Champ, P.A., J.R. Meldrum, H. Brenkert-Smith, T. Warziniack, C. Barth, L.C. Falk, and J. Gomez. Risk Preferences and Risky Choices in the Context of Wildfire. *Environmental and Resource Economics*.
Meldrum, J.R., H. Brenkert-Smith, P.A. Champ, L. Falk, and C. Barth. A Quantitative examination of social complexity across wildland urban interface communities. *Society and Natural Resources*. R&R

Presentations

2015

Meldrum, J.R. Decision-making about natural hazards: Wildfire risk in Colorado. U.S. Environmental Protection Agency (EPA) Seminar, Research Triangle Park, NC, Jan 21, 2015. (invited)

Champ, P.A. Wildfire risk and homeowners: Like a Moth to a Flame? North Carolina State University, Center for Environmental and Resource Economic Policy Colloquium, February 27, 2015 (invited).

Meldrum, J.R., Champ, P., Warziniack, T., and Brenkert-Smith, H. Wildfire risk mitigation: What do homeowners (think they) have to lose? W-3133 Meeting: Benefits and Costs of Natural Resources Policies Affecting Public and Private Lands, Pensacola, FL, Feb 25-27, 2015.

Barth, C and P.A. Champ. Paradise in a Powder Keg: Wildfire Risk and Wildland Urban Interface Residents (invited).

- University of Montana, Department of Economics Seminar Series. March 9, 2015;
- Missoula Fire Sciences Laboratory in Missoula, March 10, 2015.

Champ, P.A. Risk Preferences and Wildfire Risk Mitigation. Association of Environmental and Resource Economists 4th Annual Summer Conference. San Diego, CA. June 5, 2015.

Meldrum, J.R., Champ, P., Warziniack, T., and Brenkert-Smith, H. Understanding community wildfire adaptedness by developing and applying a process-based Adaptedness Index with data envelope analysis. 21st International Symposium on Society and Research Management (ISSRM), Charleston, SC, Jun 13-18, 2015.
Falk, L. and P.A. Champ. Don't Believe Everything You Think: Research to Inform Homeowner Mitigation. Colorado Wildfire Conference, Snowmass Village, CO September 25, 2015.

Barth, C., Falk, L., and Meldrum, J.R. Whose definition of risk? Multiple risk analysis methods used within one Southwest Colorado community. 2015 Colorado Wildland Fire Conference, Snowmass Village, CO, Sep 24-26, 2015.

Champ, Patricia A., Travis Warziniack, James Meldrum and Hannah Brenkert-Smith. Homeowner Risk Mitigation and Community Wildfire Adaptedness. Backyards and Beyond Wildfire Education Conference. Myrtle Beach, SC. October 22, 2015.

2016

Champ, Patricia A. Science meets the manager – Using socio-economic research to inform and transform WUI residents, wildfire risk education programs, and research, RMRS Sneak Seminar, Human-Landscape Interactions, March 8, 2016.

Brenkert-Smith, H., C. Barth, P. Champ. L. Falk., J. Meldrum. 2016. Infusing social science into wildfire education programs through collaboration and systematic data collection. [panel presentation] Interactions of Society and the Environment Seminar Series, November 2, 2016, Fort Collins, CO. (invited)

Brenkert-Smith, H. and P. Champ. 2016. The Wildfire Research (Wirē) Team: Infusing social science into wildfire education programs through collaboration and systematic data collection. Presentation to State Forest Service Leadership Team. 20 December 2016, Fort Collins, Colorado. (invited)

2017

Champ, P. and H. Brenkert-Smith. 2017. The Wildfire Research (Wirē) Team: Infusing social science into wildfire education programs through collaboration and systematic data collection. Fire Adapted Colorado meeting – Fort Collins, CO, 1 February 2017. (invited)

Champ, P. and J. Meldrum. The Wildfire Research (WiRē) Team: systematic data to address the social aspects of wildfire. Front Range Fuels Treatment Partnership Roundtable; Community Protection and Landscape Restoration Teams. Denver, CO. March 22, 2017. (Invited).

Champ, Patricia A. “Adapting to Wildfire: Moving beyond Homeowner Risk Perceptions to Taking Action” A century of wildland fire research: Contributions to long-term approaches for wildland fire management. National Academies of Sciences, Engineering, and Medicine. Washington DC. March 27, 2017 (Invited).

Champ, P., L. Falk, and C. Barth. The Wildfire Research (WiRē) Team: Infusing Social Science Into Wildfire Education Programs Through Collaboration And Systematic Data Collection. 2017 Colorado Wildland Fire Conference, Apr 19, 2017, Pueblo, CO.

Meldrum, J.R. and Gomez, J. 'Nudges' in the WUI: Results from a novel experiment on engaging WUI residents. 2017 Colorado Wildland Fire Conference, Apr 19, 2017, Pueblo, CO.

Brenkert-Smith, H. and C. Barth. Where you stand depends on where you sit: Qualitative inquiry into notions of wildfire adaptation. Colorado Wildland Fire Conference, Pueblo, CO, 20 April 2017.

Meldrum, J.R. Using economics and social science to support the National Cohesive Strategy: outcomes from a long-running, research-practitioner collaboration centered around community-specific data. USGS Fire Science Community of Practice webinar, Apr 20, 2017. (invited)

Brenkert-Smith, H., and P. Champ. 2017. Uniting research and practice to promote fire adaptation: The Wildfire Research (WiRē) Team. National Cohesive Strategy Workshop, Reno, NV, 26 April 2017.

Meldrum, J.R. 2017. Promoting fire adaptation through research: Progress from a long-running research-practitioner collaboration. US Forest Service Southern Research Station Seminar, Research Triangle Park, NC, May 15, 2017. (invited)

Barth, C., Brenkert-Smith, H., Gomez, J., and Meldrum, J.R. 2017. WiRē: Uniting Research and Practice to Address “Last-Mile” Wildfire Problems. Natural Hazards Research and Applications Workshop, Broomfield, CO, Jul 9-12, 2017.

Champ, P.A., J. Gomez. The Wildfire Research (WiRē) Team: Infusing social science into wildfire education programs through collaboration and systematic data collection. West Region Wildfire Council Meeting. September 14, 2017 (Montrose, CO). (invited)

Poster Presentations

Individual and Community-level Influences on Wildfire Risk Mitigation Decisions on Private Property. James Meldrum, Hannah Brenkert-Smith, Patricia Champ, Travis Warziniack. Association of Environmental and Resource Economists 5th Annual Summer Conference, June 9-11, 2016. Breckenridge, CO.

The Wildfire Research (WiRē) Team: Infusing social science into programs through collaboration and systematic data collection. Hannah Brenkert-Smith, Chris Barth, Patricia Champ, Lilia Falk, Pam Froemke, Jamie Gomez, James Meldrum, Travis Warziniack, Pam Wilson. University of Colorado, Natural Hazards Center, Natural Hazards Workshop. July 10-12, 2016. Broomfield, CO.

Social science contributions to the National Cohesive Wildland Fire Management Strategy. James Meldrum. DOI Economics Conference. Apr 5-7, 2017, Washington, D.C.

Research Notes

Meldrum, J.R., C.M. Barth, L.C. Falk, H. Brenkert-Smith, T. Warziniak, P.A. Champ. 2015. Living with wildfire in Delta County, Colorado: Cross-community Comparison. Research Note RMRS-RN-67. June 2015.

Meldrum, James R.; Falk, Lilia C.; Gomez, Jamie; Barth, Christopher M.; Brenkert-Smith, Hannah; Warziniack, Travis; Champ, Patricia A. 2017. Living with wildfire in Telluride Fire Protection District, Colorado. Res. Note RMRS-RN-75. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 30 p.

Meldrum, J.R., Brenkert-Smith, H., Wilson, P., Champ, P., Barth, C., and Boag, A. [in press]. Living with wildfire in Archuleta County, Colorado: 2015 Data Report. Research Note RMRS-RN-XX. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: XXpp.

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Meldrum, J.R., Brenkert-Smith, H., Wilson, P., Champ, P., Barth, C., and Boag, A., [in press]. Living with wildfire in Montezuma County, Colorado: 2015 Data Report. Research Note RMRS-RN-XX. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: XXpp.

Media and other

Article: Around the Firewise Home: Social Dynamics Found Effective for Encouraging Wildfire Risk Reduction. In Firewise How-To. Winter 2015.

Highlighted in RMRS congressional briefing document “Leading efforts to understand the complexities of Wildland Fire” May 2017.

FEMA US Fire Administration (USFA) website/newsletter

(https://www.usfa.fema.gov/current_events/index.html#costsharing) “Homeowner participation in wildfire mitigation cost-sharing programs” May 18, 2017.

Brenkert-Smith, H., and the WiRē Team. 2017 Near misses and far-sightedness: Boulder fire is a reminder of the need for community collaborations. Invited commentary. <https://hazards.colorado.edu/article/near-misses-and-far-sightedness-boulder-fire-is-a-reminder-of-the-need-for-community-collaborations>, March 24, 2017.

Meldrum, J., Barth, C., Champ, P., Brenkert-Smith, H., Falk, L., and Warziniack, T. [in press]. Insurance and wildfire mitigation: what do we know? *Fire Management Today* 75(2).

Appendix C Metadata

The data include household survey data from surveys paid for and collected by local wildfire councils and used with their permission. In addition, data from parcel-level rapid wildfire risk assessments administered by the West Region Wildfire Council and FireWise Southwest Colorado are included. The details are in the metadata file.

Data will be archived at the US Forest Service data archive location: <https://doi.org/10.2737/RDS>.