What Motivates Individuals to Protect Themselves from Risks: The Case of Wildland Fires

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This research investigates the cognitive perceptual process that homeowners go through when faced with the decision to protect themselves from the risk of wildfires. This decision can be examined by looking at the interaction between the integrated protection motivation theorytranstheoretical model and different levels of homeowners' subjective knowledge related to wildfire risks. We investigated the role of motivation, decision stages of risk readiness, and subjective knowledge on the number of risk-mitigating actions undertaken by homeowners living in high-risk communities. The results indicate that homeowners who are in an early or precontemplative stage (both low and high subjective knowledge) as well as low knowledge contemplatives are motivated by their perceived degree of vulnerability to mitigate the risk. In contrast, high knowledge contemplatives' potential behavioral changes are more likely to be motivated by increasing their perceptions of the severity of the risk. Risk-mitigating behaviors undertaken by high knowledge action homeowners are influenced by their perceptions of risk severity, self-efficacy, and response efficacy. In contrast, the low knowledge action homeowners engage in risk reduction behaviors without the influence of any of the PMT variables; demonstrating their motivation to emulate others in their community. These results have implications for the type of information that should be used to effectively communicate risks in an effort to influence the diverse homeowner segments to engage in risk-reduction behaviors.

KEY WORDS: Natural hazards; protection motivation theory (PMT); risk communication; risk perceptions; subjective knowledge; transtheoretical model (TTM)

1. INTRODUCTION

The question of why individuals choose to mitigate, downplay, or ignore risk has been a topic of much research over the last 25 years in areas for natural- and human-caused risks (e.g., smoking, earthquakes, contraceptive use, alcohol consumption, flooding). Wildfire has been a relatively recent focus in the natural hazards literature as a result of the last 5 years of catastrophic fires in the western United States. The desire of many to live in areas that provide wildland amenities has led to significant population migration into rural, forested areas of the West, exacerbating the risks of large-scale, catastrophic wildfires. This migration has resulted in more people living in the wildland-urban interface (WUI), which has created many unique problems for homeowners as well as land managers. The WUI is the area where homes and structures are built adjacent to or within vast tracts of flammable vegetation. Research has demonstrated that on private property, a home's exterior materials and its immediate surroundings principally determine the home's ignition potential during extreme wildfire events.⁽¹⁾ Yet, many of these homeowners choose not

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to undertake mitigating actions to protect their homes from the risks of wildfire. Our primary focus in this research is on the potential risks of wildfire to one's property and not to the risks to life.

The objective of this research is to use stage theories with health behavior theories to investigate the cognitive perceptual process that homeowners experience when faced with the decision to protect their property and themselves from a risk such as wildfires. We expand this emerging stream of research, which integrates protection motivation theory (PMT) and the transtheoretical model (TTM), by examining the potential differences between individuals with more or less knowledge related to mitigating wildfire risk.⁽²⁻⁵⁾ Individuals at different decision stages (TTM) are differentially affected by the PMT variables of vulnerability, risk severity, and ability to reduce that risk. An individual's personal experience with a risk as well as the type of knowledge he or she possesses are reflected in his or her respective degree of subjective knowledge.⁽⁶⁾ Their level of subjective knowledge with a particular risk interacts with the PMT risk variables to affect their willingness to move from one stage of readiness to the next stage in order to mitigate their risk (their placement in the decision stage—TTM).⁽⁷⁾ Next, we present a discussion of the literature, followed by a description of the methodology, along with the data analyses and results. Lastly, we discuss the managerial and public policy implications from our research.

2. THE INTEGRATED THEORY OF PMT AND TTM MODEL

There is a long history and established body of literature devoted to health behavior models such as PMT and in decision stage theories such as the transtheoretical model (TTM). More recently, the literature that integrates these two types of theories has emerged to provide a more complete description of risk mitigation in different contexts.^(2,4,5,7–11)

According to PMT, people can be motivated to engage in desirable health behaviors to avoid health risks, social risks, and interpersonal risks.^(7,12) This research focuses on the impact of risk information (e.g., anti-smoking messages) on the elicitation of both appraisal and coping techniques.⁽¹³⁾ Assessments of threats (severity, vulnerability, and benefits) and coping factors (self-efficacy, response efficacy, and costs) combine to form a motivation in individuals to protect themselves from the risk. In the case of wildfire risks, the likelihood of an individual undertaking riskreduction behaviors is increased by (1) the belief in one's vulnerability to the wildfire risk—both physical property and health, (2) the belief in the severity of the wildfire risk, (3) the belief that one can successfully avoid the risk of wildfire, and (4) the belief that risk-reduction behaviors are effective ways to mitigate the risk of wildfire. In contrast, the likelihood of not doing anything about the risk of wildfire is increased by intrinsic rewards (e.g., enjoying your trees and privacy), extrinsic rewards (e.g., peer approval neighbors who are like-minded concerning the beauty of the trees and forests), and the costs of an adaptive response (e.g., the costs of creating and maintaining defensible space on your property).

The cognitive perceptions (vulnerability, risk severity, and efficacy) can enhance the persuasive effects of a risk communication strategy that elicits protection motivation. By eliciting protection motivation in people, risk information can then arouse, sustain, and direct activities for self-protection such as increasing the number of risk-reduction behaviors, working to reduce some of the involuntary risks created by neighbors, and maintaining these risk-reduction behaviors over time. Strong beliefs in risk vulnerability, severity, self-efficacy, and response efficacy will arouse the motivation to protect oneself and one's property and result in a change in the adoption rate of risk-reduction behaviors.^(8,14) Whether individuals are equally motivated to reduce the threats of risk by these four variables has been a recurring question in the literature.^(2,10,11)

A parallel stream of research in decision stage theories (such as TTM) has been used to examine health behavior change based on the assumption that a set of variables will influence different people in different ways.⁽¹⁵⁾ The degree of readiness to accept and act on a risk has been shown to impact individuals' motivation to protect themselves from a risk. Stage theories specify an ordered set of categories into which people can be classified. Based on this categorization, one can identify the factors (e.g., vulnerability, risk severity) that can explain how to more effectively communicate with each subgroup.⁽¹⁶⁾ The basic premise is that people can be distinguished based on those who have not yet decided to change their behavior, those who have decided to change, and those already performing the new behavior. The TTM proposes six decision-making stages that an individual faces when exposed to a risk-precontemplation, contemplation, preparation, action, maintenance, and termination.⁽¹⁷⁾ People are assigned to one of the six stages or some subset of these six stages based on their

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behavior and intentions to undertake risk-mitigating actions. $^{\left(17\right) }$

Taken in isolation, these two streams of research (stage theories and health behavior theories) do not individually provide the conditions under which we can determine what will motivate an individual to move from one decision stage to the other. Integrating these two types of theories can provide a more complete picture of the cognitive and motivational process that individuals go through to mitigate wildfire risk in their lives. Numerous health behavior theories such as PMT specify factors such as response efficacy or risk severity that can produce a transition between the stages of readiness. (2,4,5) For example, Block and Keller found that people are at different stages of readiness to undertake medical testing, which can in turn be affected by the four cognitive processes in PMT.⁽²⁾ They integrated three of the six stages of TTM into the PMT model to provide a more effective way of understanding people's responses to risk and risk communication. They found that the degree of vulnerability, risk severity, self-efficacy, and response efficacy are differentially perceived as critical motivators for people in the precontemplative, contemplative, and action stages.⁽²⁾

In the hazards literature, Martin, Bender, and Raish tested the integrated PMT-TTM model developed by Block and Keller to understand how to influence wildfire risk-mitigating behaviors. They demonstrated that in the precontemplative decision stage, increasing individuals' perceived vulnerability to wildfire risks was a key motivator.⁽¹⁸⁾ Likewise, homeowners in the contemplative stage were motivated by increases in perceived risk severity and vulnerability. Finally, the authors also showed that for action homeowners, increasing homeowners' response efficacy and self-efficacy increased the number of riskmitigating behaviors that were undertaken.⁽¹⁸⁾ The authors also found that perceptions of risk severity increased moving from precontemplative to contemplative to action homeowners, with action homeowners having the highest level of risk perception.

The PMT-TTM model explains what risk variables are most effective at motivating individuals in the various decision stages. This type of model does not assume that homeowners are rational or unbiased. In the psychological risk paradigm, researchers have demonstrated that people use mental heuristics to evaluate risk.^(19,20) Each of the cognitive appraisal processes can be biased by a heuristic judgment. The psychological risk paradigm has demonstrated repeatedly the difficulties that individuals have in un-

derstanding risk probability, biased media coverage, misleading personal experiences, and more, leading to the overestimation or underestimation of risk. Slovic described a number of risk dimensions (e.g., dread and unknown) that cause perceptions to vary across people, experiences, and individual characteristics.⁽¹⁹⁾ This stream of research has brought attention to the multiple dimensions of risk and that individuals respond differently depending on the type of risk, features of the hazard, and individual characteristics such as expertise. A potential impact on the motivation to protect oneself from a risk is the individual's subjective knowledge of wildfire and vividness of previous wildfire experience. We explore the impact of subjective knowledge of wildfire and its risks, which is often based on homeowners' experiences (such as being evacuated, losing structures, seeing smoke or fire, neighbors' or friends' experiences, and other vivid sources of information) as well as a desire to learn more about these risks. Understanding the impact that knowledge brings to the motivational process when individuals face the risks of natural disasters can aid policymakers as well as managers in the decisionmaking process. We discuss this in more depth in the following section.

3. THE ROLE OF SUBJECTIVE KNOWLEDGE

The increasing residential development of lands in forested areas and the build up of fuels over the past century would indicate that homeowners' experience and their resulting subjective knowledge of wildfires are an important factor to consider in the quest to reduce the severity of wildfire risk and the vulnerability of homeowners to that risk. Many of the fire regimes in the West have frequent fire return intervals, some as frequent as every 5 years. In addition, fire managers are increasingly trying to bring fire back into these ecosystems (e.g., through prescribed fire and natural wildfire use) to benefit the vegetation and land. The differential levels of subjective knowledge among homeowners concerning wildfire, prescribed fire, and natural fire as a management tool need to be further explored to more fully understand how the range of homeowner motivation, the decision stage of the individual, and knowledge level can contribute to the successful education of homeowners that live in the WUI.

Homeowners' subjective knowledge is based on their respective direct experience (whether they were evacuated, lost property, etc.) and indirect experience (e.g., reading information, experts, word-of-mouth) with a particular category of interest such as the risk of wildfire.⁽²¹⁾ Personal experience can have a powerful impact on the recognition of risk and the willingness to protect oneself from the risk.⁽⁴⁾ These past experiences become the foundation for individuals' belief in their own knowledge about a risk,⁽¹⁹⁾ and may potentially affect their decision-making stage within the risk-reduction continuum. Research in cognitive psychology has shown that experts and novices differ in the amount, content, and the organization of domain-specific knowledge.^(22,23) An expert is defined as a person who has the necessary knowledge to make decisions on what steps to take to mitigate wildfire risks to his or her person and property.⁽²⁴⁾ A novice does not have this necessary knowledge to make a reasoned decision to mitigate risks. For example, people who have only heard about the risk of wildfire (novices) share a need for information about its relevance to their own personal situation before they can be convinced to undertake some critical risk-mitigating behaviors (cutting back trees from one's home, etc.), thus increasing their subjective knowledge.⁽¹⁶⁾

To be able to select the optimal risk-mitigating actions, the homeowner must be aware of the alternative actions (see Appendix for the list) and able to implement these actions.⁽²⁵⁾ The extant literature in knowledge has consistently demonstrated that experts have much greater awareness and knowledge about a particular risk and alternative strategies to deal with the risk.⁽⁶⁾ In contrast, less knowledgeable segments tend to recall less information related to the risk and their knowledge tends to be episodic (e.g., causal relationships between risk-mitigating actions and reducing their personal vulnerability and risk severity tend to be missing). This implies that knowledgeable homeowners understand the cause and effect relationships between various risk-mitigating actions and the probability of being impacted by the risk of property and physical loss.

One heuristic that people use to judge the probability of an event is based on its availability or the ease with which it is brought to mind.⁽²⁰⁾ Availability depends not only on frequency of the hazard but also its timing (recent vs. distant), the relationship to other people experiencing the hazard, and the nature of the outcome (e.g., property destroyed, lives lost). The higher the availability of the risks in the homeowner's memory, the more the homeowner will perceive the risk of that event as high. Weinstein posits that the effects of personal experience with a hazard on protective behavior lead people to see the risks as more frequent and to view themselves as potential

future victims, thus increasing their protection motivation.⁽⁷⁾ Homeowners' subjective knowledge is increased as they are influenced by their experience with the risk and through various types of communication sources (e.g., the mass media, USFS, Firesafe Councils). Sattler et al. found that people tend to base their risk awareness of future hazards on the extent of the potential damage and the psychological stress of the past experience.⁽²⁶⁾ The authors found that people perceive past experiences as indicative of future experience, consistent with the availability heuristic.⁽²⁶⁾ Furthermore, experience with a risk usually enhances perceived risk immediately following the event ^(27,28) although it appears to subside quickly as time passes.^(7,29) In addition, the frequency of disasters or natural hazards has been shown to motivate people to take more preventive actions against future hazards.⁽³⁰⁾ Frequent exposure to hazards increases the realistic assessment of the risk, and the prevalence of mitigation measures.⁽²⁷⁾

In summary, we predict that residents of these communities are not a homogeneous group but instead are heterogeneous enough to warrant a better understanding of what motivates them to reduce the risks they face living in the WUI. We suggest that people at different levels of readiness and with different amounts of knowledge and experience are motivated differently by levels of vulnerability, risk severity, selfefficacy, and response efficacy. In the next section, we discuss the methodology used to test this integrated model of PMT-TTM and differing levels of subjective knowledge.

4. METHODOLOGY

We focused on communities located in the WUI in the western United States that have faced recurring wildfires. Two of the three communities were targeted for their extensive experience with large-scale fires, while the third community had a more distant and not as severe history with wildfires. The sampling frame was the homeowner association lists, which were obtained for all three communities. All residents of the communities (both part-time and full-time residents) were sent a survey that included the measures described later. We included the entire populations of the three communities as our sample. The mail survey was sent out with a cover letter explaining the project and included a self-addressed, stamped envelope for residents to return the completed survey. A reminder postcard was sent out about 3 weeks after the first mailing.

Prior to sending the survey, we conducted focus groups in each community with a subset of the residents, at least one special interest group, and representatives from the U.S. Forest Service District Ranger's office. The purpose of the focus group interviews was to get an in-depth understanding of the particular characteristics of the communities, the wildfire(s) that had affected the area, and any other issues or problems that were specific to the community. The participants in the focus groups were selected because they were seen as more active in their respective communities. In addition, they were also perceived as more willing to discuss the community's history, wildfire history, and other relevant topics with us. This provided a more in-depth understanding of the community. In addition, the participants in these focus groups were also given the survey. We compared each set of focus group participants with the mail survey respondents to determine if there was any nonresponse bias.⁽³¹⁾ Based on a set of *t*-tests on a subset of the risk perception, self- and response efficacy measures, we found that there were no significant differences between these two groups thus, the nonresponse bias was minimized.

4.1. Sample

We received 238 completed and usable surveys out of 423 mail surveys from all three communities for a response rate of 57%. The response rate for a mail survey was found to be above the average response rate for surveys.⁽³¹⁾ A description of each community provides a picture of the relevant attributes for each group.

4.1.1. Central Colorado

The first location was in central Colorado, surrounded by the Pike National Forest. In June 2002, the Hayman fire burned over 138,000 acres north and west of this community. Almost 70% of the homeowners were evacuated in the Hayman fire when the fire came to within 5 miles of the community. This community is composed of full-time residents with the majority living in the area more than 10 years. Approximately a quarter of the residents moved into the area less than 5 years ago. The residents' demographic characteristics are: 55% over the age of 55, highly educated with 65% having at least a college degree, and the community is fairly affluent with 85% citing a yearly household income of over \$50,000.

4.1.2. Northern Colorado

The second location was in northern Colorado in a community that is completely surrounded by the Roosevelt National Forest. Although these homeowners have experienced numerous fires in the past 10 years, none of the fires warranted the evacuation of the community. The demographic characteristics are: 63% of the homeowners are over the age of 55, 82% have attained at least a college degree, and 62% earn more than \$50,000 per year.

4.1.3. Central Oregon

The third community is in central Oregon, surrounded by the Deschutes National Forest. This community was evacuated twice during the B&B Complex fire (includes both the Bear Butte and Booth Fires). The demographic characteristics of this community are: 60% of the homeowners are over 55 years of age, they are highly educated with 75% of the respondents having at least a college degree, 50% of the homeowners are part-time residents, and 57% have a yearly household income of over \$75,000.

4.2. Independent Measures

4.2.1. Risk Perception Measures

Vulnerability and risk severity are the critical risk perception measures in the PMT literature. Risk vulnerability is defined as the likelihood of harm to property and self if there is no change in behavior and is measured using two 7-point Likert scales by asking "how vulnerable do you feel about the possibility of a wildfire physically affecting you or your family (property or possessions)" anchored by 1 = not at all vulnerable to 7 = extremely vulnerable ($\alpha = 0.78$). Risk severity is defined as the amount of hardship that would occur if one experienced the risk. We measured risk severity using two 7-point Likert scales by asking "how serious do you feel the negative consequences of wildfires are to you personally/how severe will the impact of a wildfire be where you live" anchored by 1 =not at all serious/no harm at all to 7 =extremely serious/extremely devastating ($\alpha = 0.87$).

4.2.2. Self-Efficacy Measures

Self-efficacy is defined as the belief that one is capable or not capable of performing a risk-mitigation behavior.⁽³²⁾ The measures of self-efficacy were developed based on measuring how confident respondents felt about their ability to protect their property and themselves from the risk of wildfire. Respondents were asked "how confident do you feel in your ability to do the following risk reduction behaviors" as well as "how confident do you feel in general about your ability to protect yourself and your property from wildfire," anchored by 1 = not at all confident to 7 = very confident. These 11 measures were combined into a composite measure of self-efficacy ($\alpha = 0.72$).

4.2.3. Response Efficacy Measures

Response efficacy is defined as the degree to which a proposed risk-mitigation behavior is perceived to be effective at reducing a particular risk. Respondents were asked to rate the effectiveness of the risk-reduction behaviors using the following method. They were asked to rate "how effective are the following actions at helping to reduce the risk of fire impacting your property and lives" followed by the list of the 11 risk-reduction behaviors (see Appendix) and each item was anchored by 1 = not at all effective and 7 = very effective. These 11 measures were combined into a composite measure of response efficacy ($\alpha = 0.84$).

4.2.4. Additional Measures

Additional measures were taken to obtain a better understanding of what motivates people to protect themselves against the risk of wildfire. We asked respondents, using an open-ended format, to explain the biggest impediments that they faced when deciding to take some protective action on their property. Two researchers independently coded the responses into categories. The coders were blind to our hypotheses, with a resulting set of 12 categories of cited impediments. Finally, we ended the survey with a set of demographic questions. A summary of this information is included in the community descriptions above.

4.3. Dependent Measure–Behavioral Action Measures

The primary measure of adaptive coping was the *intentions* of homeowners to change from not undertaking any risk-reduction behaviors to undertaking a set of behaviors. This is consistent with the integrated PMT-TTM model.⁽⁴⁾ The dependent measure is the number of risk-reduction behaviors that homeowners have undertaken or intend to undertake to protect their property and themselves from the risk of wildfire. Using multiple risk-reduction behaviors suggests a more parsimonious use of interventions, targeting groups of behaviors related to reducing the risk of wildfire affecting one's property and self. This also implies that one type of risk-reduction behavior is not better than another but that the more behaviors one engages in the more likely they are to reduce the negative impact of wildfire risks. The PMT, TTM, and integrated PMT-TTM literatures have all focused on a single-act criterion to mitigate a particular risk. We expand on this research by examining a composite measure of the generally accepted risk-reducing behaviors for life in the WUI.

We used the 11 risk-reduction behaviors listed by the Firesafe Council of California as the accepted means to mitigate wildfire risk to one's property and self (www.firesafecouncil.org) (see Appendix for the complete list of behaviors). Each behavior was measured using the following scale: 1 = already done, 2 =will do next month, 3 = will do in 3–6 months, 4 = will do within the next year, and 5 = probably will not do. The 11 measures are an average of the ratings of the 11 risk-reduction behaviors formed into a composite measure for each respondent ($\alpha = 0.64$).

4.4. Categorization into Decision Stages

For the purposes of our research, we focused on three of the six stages of the PMT-TTM model similar to Block and Keller and Martin et al.^(2,18) Most empirical studies limit the analysis to a subset of these six stages.⁽³³⁾ To classify respondents into one of three possible decision stages, we used the number of actual behaviors that they undertook to mitigate their risk consistent with research in stage theories in the extant literature.⁽³³⁾ Each homeowner was categorized based on the number of risk-reduction behaviors that they undertook to protect themselves. A frequency distribution was run on categories for the composite actual behavior measure. The resulting trimodal distribution was used to categorize respondents into precontemplatives, contemplatives, and action homeowners (n = 58, 86, 94, respectively). A person was categorized as being in the "Action" stage if he or she had already completed seven or more behaviors. A person was categorized as "Precontemplative" if he or she had five or more behaviors that they answered as "will not do." All those who did not fall into the "Action" or the "Precontemplative" categories were classified as "Contemplatives."

4.5. Categorization into Subjective Knowledge Stages

To measure the impact of homeowners' subjective knowledge, we asked them to rate: "How well informed do you consider yourself to be about wildfire and wildfire risks?" "To what extent do you find information about wildfires to be personally relevant?" and "How motivated are you to learn more about the connection between wildfire risks and actions to create defensible space?" The scale items are anchored by 1 = not at all informed/personally relevant/motivated and 7 = very informed/personallyrelevant/motivated ($\alpha = 0.69$). These measures have been used in the expertise literature to measure subjective knowledge.⁽⁶⁾ A median split was done on this composite measure to categorize homeowners based on either high or low subjective knowledge. Respondents that rated 6 and above on the 7-point scale were categorized as high subjective knowledge and those rating their knowledge less than 6 were categorized as low subjective knowledge. Given that these homeowners had varying degrees of extensive fire experience over the last 5 years, their subjective knowledge ratings were skewed upward. This is consistent with the literature in knowledge calibration that demonstrates that consumers tend to think they know more than they actually $do.^{(34)}$

5. ANALYSES AND RESULTS

5.1. Design

Two hundred thirty-eight homeowners (57%) in the three communities completed the survey. First, we conducted a set of contrasts to determine if there were significant differences in terms of risk-reduction behaviors for these three communities. Since the results demonstrated that there was no significant difference, we combined the groups. Subsequently, an overall regression equation was run for the entire sample using behavioral intentions as the dependent variable regressed on the four PMT measures (see Table I, last column). The regression analysis indicated significant beta coefficients for all four predictor variables. Given that all four PMT variables were significant, we investigated the possibility that depending on where individuals are in the decision process and their level of knowledge, they will be differentially motivated to reduce their risks. Respondents were then categorized into one of the three groups based on the "decision stage categorization" and one of two groups based on the "subjective knowledge categorization" (described earlier) to investigate the differential impact of the decision stages and subjective knowledge on the PMT measures. The results from the overall regression equation are consistent with previous studies in PMT. ^(2,9,10)

5.2. Decision Stages and Subjective Knowledge—Regression Results

To evaluate the differential relationship between the six groups, we implemented a set of general linear regressions on the composite behavioral intentions measure for each decision stage by level of subjective knowledge (see Table I). We used vulnerability, severity, self-efficacy, and response efficacy as the independent variables and the composite measure of the behavioral action as the dependent variable. The result for the first regression for the precontemplatives (both low and high subjective knowledge) demonstrates that the only significant predictor of behavioral actions (coping response) was perceived vulnerability, which is consistent with the literature.⁽²⁾ For precontemplatives, they consider mitigating their risk when they feel vulnerable about the risks of wildfire. For the contemplatives, the regression results differ based on the level of subjective knowledge. The

	Decision Stage by Knowledge Level						
	Precontemplatives Knowledge		Contemplatives Knowledge		Action Knowledge		
	Low	High	Low	High	Low	High	Overall
Vulnerability	-0.42**	-0.31**	-0.20**	-0.06	0.01	0.01	-0.12**
Severity	0.05	0.02	-0.04	-0.11^{*}	-0.11	-0.11^{**}	-0.10^{**}
Self-efficacy	0.10	0.13	-0.04	-0.03	-0.08	-0.19^{*}	-0.13^{*}
Response efficacy	0.02	-0.05	-0.08	-0.06	-0.10	-0.11^{**}	-0.28^{**}
Ν	45	13	36	50	28	66	238
<i>R</i> ²	0.72	0.68	0.33	0.16	0.22	0.27	0.33

 Table I. Beta Coefficients and p-Values

 for Behavioral Intentions Regressed on

 Vulnerability, Severity, Self-Efficacy, and

 Response Efficacy

<i>Note</i> : $*p < 0.05$ and $**p < 0.001$. Degrees of freedom: 5, 232 for the overall model and 4, 40; 4
8; 4, 31; 4, 45; 4, 23; and 4, 61 for each of the main effects, respectively.

significant predictor of behavioral actions for the low knowledge contemplatives was perceived vulnerability similar to the precontemplatives. Thus, increasing feelings of vulnerability led to greater intentions to engage in risk-reduction behaviors. In contrast, for the high knowledge contemplatives, perceived risk severity was the critical motivating factor. What differentiated the first three groups from high knowledge contemplatives was the importance that risk severity has with the latter group. The high knowledge contemplatives are more likely to be motivated to engage in risk-mitigating behaviors if they experience increased levels of risk severity. For example, these homeowners must believe that severe impacts will occur from a wildfire, for example, due to an ongoing drought, motivating them to remove leaves from their roof and yard (coping response).

In the action group, the differences that emerged between low and high knowledge segments were unexpected. The significant predictors of self-efficacy and response efficacy confirm their influence on riskmitigating behaviors for the high knowledge action homeowners (see Table I). These high knowledge action homeowners need to believe that they have effective means to reduce the risks associated with wildfire. The unexpected result for the high knowledge action phase was that risk severity was also significant. For the low knowledge action homeowners, the surprising result was that none of the PMT motivators were significant. Overall, these results demonstrate that the six groups of homeowners are differentiated based on not only their stage of readiness but also their level of subjective knowledge. Thus, determining what is critical to effectively communicate the risks of wildfire takes on a new importance. This will be discussed in the final section of the article.

5.3. Biggest Impediments to Risk Reduction

To obtain a better understanding of why homeowners in different decision and knowledge-level stages were more or less likely to undertake riskreduction strategies, we asked them to state factors that impeded their decision to mitigate their risks (see Table II).

There were two similarities in what respondents stated were the biggest impediments, consistent with PMT across the decisions stages by knowledge groups—"denseness of the surrounding forests" and the "aesthetics associated with homeowners' properties"—to protecting oneself and property from the risk of wildfire. These were two reasons that were common to all decision stages and levels of knowledge, and they were given as reasons more often (8 of the 12 impediments) than the others. These two impediments are related to these homeowners' close proximity to public and private forested land. One

	Decision Stage by Knowledge Level						
	Precontemplatives Knowledge		Contemplatives Knowledge		Action Knowledge		Total
	Low	High	Low	High	Low	High	Responses
1. Cost	10	2	0	11	4	7	34
2. Time	6	0	3	9	1	1	21
3. Others Pose Risks	3	2	1	4	1	8	19
4. Dense Forest Conditions	4	2	4	4	2	5	22
5. Aesthetics	4	3	3	2	3	2	17
6. FS Does Nothing	2	0	1	6	1	6	16
7. Wildfire is Uncontrollable	2	1	0	4	2	3	12
8. Mother Nature	1	0	0	5	1	3	10
9. Age & Physical Ability	1	0	1	2	1	4	9
10. Vacation Home	3	0	3	0	1	0	7
11. No slash disposal	0	0	0	1	1	2	4
12. No Impediments	0	1	1	3	3	5	13
Total Responses	36	11	17	51	21	47	175
Ν	45	13	36	50	28	66	238

 Table II. Biggest Impediment to

 Creating Defensible Space (Number of

 Times This Response Was Stated)

stark similarity was based on what was not stated by any of the participants in this research. Not one of the respondents in these three communities stated that their ownership of homeowners' insurance was a reason for not undertaking any or all of the riskmitigating behaviors.

With regard to differences, the results are much more diverse (see Table II). Differences between the low and high knowledge precontemplative groups were focused on the cost of creating defensible space and the time it takes to engage in these behaviors. The low knowledge precontemplatives cited cost and time more often as an impediment compared to the high knowledge precontemplatives. Other than these two impediments, they were similar on all the other impediments listed; overall these two groups listed very few impediments. An effective risk communication strategy for these two groups of precontemplatives could be to provide information on the tradeoffs between not engaging in risk-mitigating behaviors due to high costs and time pressures and the increased vulnerability that they face by not doing something to reduce the risk (vulnerability-enhancing information). This is consistent with the PMT-TTM model, as homeowners in the precontemplative stage are not motivated to protect themselves by efficacious measures. They first need to understand the vulnerability of their homes and lives before they can make the link to the severity of the risks associated with wildfire, the effectiveness of the protective actions and confidence in their ability to carry out the actions.⁽²⁾

In stark contrast to the precomplatives, the contemplatives differed in the types of impediments that they listed for the low and the high subjective knowledge individuals consistent with the differences in the earlier analysis (see Table II). For the high knowledge contemplatives costs, time, the issue of inaction on the part of the Forest Service, and the uncontrollable aspects of "Mother Nature" place these two groups at odds. For the low knowledge contemplatives, focus is on vulnerability to the risk; thus, forest conditions were stated as an impediment. In fact, the low knowledge contemplatives resembled the precontemplatives in the reasons listed for biggest impediments except for cost and time, consistent with the regression results. Thus, the same type of communication strategy may be warranted for this group as the precontemplatives, consistent with the results in Table I.

The high knowledge contemplatives focus on the uncontrollable aspects of risk-mitigating behaviors as impediments to their behaviors, which could be perceived as exacerbating the severity of the wildfire risk. Interestingly, high knowledge contemplatives listed more "uncontrollable" impediments than low knowledge contemplatives supporting their reasoning for not undertaking more mitigating actions. They view the severity of the risk as critical but have not yet engaged in a large number of risk-mitigating behaviors because they could be guided by the belief that the risk is uncontrollable. The risk communication strategy should be one that focuses on taking the "uncontrollable" nature of the risk out of wildfire risk through messages such as "even if your neighbors don't do anything, you can alter the amount of destruction of a wildfire by undertaking certain actions such as ...". In other words, focus on the personal actions that a high knowledge contemplative can engage in to reduce the uncontrollable nature of the wildfire risks.

Finally, the low knowledge action homeowners appear to be different from the high knowledge actors consistent with the differences in their motivational level. The low knowledge actors were not motivated by any of the PMT motivators and they listed fewer impediments to doing something than their high knowledge counterparts. This may be due to the fact that these homeowners act more like emulators than actual knowledgeable homeowners. They have engaged in a large number of risk-mitigating behaviors but they have less knowledge of the risks and less motivation or desire to learn more about the risks than the high knowledge segment. Thus, it seems logical that they are more likely to elicit fewer impediments as reasons for not engaging in behaviors. In sharp contrast, our high knowledge actors not only are motivated by risk severity, beliefs in self-efficacy, and response efficacy but they also see the uncontrollable nature of this risk and their environment as playing a major role in affecting their choice of riskmitigating behaviors. This indicates that high knowledge actors need information about the effectiveness of risk-mitigating actions despite the actions (or inactions) of others.

In this research, the impact of subjective knowledge on the PMT-TTM model was explored to investigate a prevalent belief in the natural hazards literature that "people are knowledgeable about the high risks of wildfire but still they do little or nothing to mitigate it." The results from our research refute the idea that knowledgeable people still do not adopt protective measures; we find that the higher the subjective knowledge the more active one is in taking preventive measures around one's home (see Table III). A set of ANOVAs on the PMT variables support the premise that there is a significant difference between high and

	Decision Stage							
	Precontemplatives Knowledge		Contemplatives Knowledge		Action Knowledge		Overall	
	Low	High	Low	High	Low	High	F's	
Vulnerability	$ \begin{array}{c} 4.85 \\ (1.55) \\ F_{1,232} \end{array} $	5.73 (1.28) = 12.91**	4.72 (1.34) $F_{1,232}$	5.77 (1.07) $= 4.34^*$	4.85 (1.42) n.s.	5.34 (1.38)	$F_{5,232} = 4.27^*$	
Severity	4.36 (1.28) $F_{1,232}$	5.63 (1.34) = 23.66**	4.67 (1.43) <i>F</i> _{1,232} =	6.00 (1.21) = 10.59**	5.02 (1.14) $F_{1,232}$	5.71 (1.16) = 5.73*	$F_{5,232} = 11.86^{**}$	
Self-Efficacy	5.02 (1.01) $F_{1,232}$	5.40 (1.07) = 20.86**	5.23 (1.08) $F_{1,232}$	6.00 (0.89) $= 6.14^*$	6.04 (0.70) n.s.	6.30 (0.58)	$F_{5,232} = 12.59^{**}$	
Response Efficacy	5.07 (0.92) $F_{1,232}$	5.71 (1.18) =16.63**	5.22 (0.91) $F_{1,232}$	6.04 (0.75) = 4.88*	5.87 (0.73) n.s.	6.10 (0.72)	$F_{5,232} = 16.17^{**}$	
Behaviors ^a	3.69 (0.73)	3.30 (0.37)	2.98 (0.53)	2.52 (0.43)	1.96 (0.39)	1.74 (0.36)	$F_{5,232} = 101.10^{**}$	
Ν	45	13	36	50	28	66	238	

 Table III.
 Means, Standard Deviations, and F-Statistics for PMT Variables Across the Three Decision Stages

 $^{a}df = 1,232.$

 $p^* < 0.01$ and $p^* < 0.001$.

Note: The values for Behaviors are 1 = already done to 5 = will not undertake the behavior.

low subjective knowledge individuals for vulnerability, risk severity, self-efficacy, and response efficacy as well as the behavioral action measure ($F_{1,232} =$ 17.98, $F_{1,232} =$ 36.83, $F_{1,232} =$ 22.79, $F_{1,232} =$ 16.55, $F_{1,232} =$ 25.48, respectively). These results do support the need for *more* than just high perceptions of vulnerability and risk severity to motivate homeowners to take preventive measures. For example, although the high knowledge homeowners have higher risk perceptions than the low knowledge homeowners, those in the action stage are motivated by the severity of the risks and their feelings of self-efficacy and response efficacy.

To better understand the difference in the knowledge levels, we investigated the differences in PMT variables by the decision stages and have the knowledge levels to assess variations in homeowner segments (Table III). This would verify that there are significant differences between the low and high knowledge level and between the precontemplative and the contemplative and the action decision stages for vulnerability, severity, self-efficacy, and response efficacy. The results indicate a positive linear relationship for the four PMT measures (see the Overall *F*'s in Table III). Consistently, the results demonstrate that within the precontemplative and the contemplative decision stages, the high knowledge segment has higher risk perceptions, higher perceptions of efficacy, and undertakes more mitigating behaviors than does the lower knowledge segment. Nine of the 12 contrasts result in a significant increase in the four PMT variables from low to high knowledge (see Table III for the cell means). Within the action decision stage, all four of the PMT variables were not statistically different although the cell means were in the hypothesized direction. The high knowledge homeowners understand the link between the tools, and have the knowledge to carry out the actions and the resulting reduction in risk from implementing the actions. In contrast, the low knowledge segment still cannot make the connection between risk perceptions and the tools and the confidence needed to reduce those risks, and despite undertaking a fair number of mitigating actions, they still believe that the risks are high and their vulnerability to the risks is high. This provides additional support that the low knowledge action homeowners are emulating what they see the high knowledge action homeowner doing.

The results from the analysis of the three action stages are somewhat different from the results for subjective knowledge. A set of ANOVAs found that depending on the decision stage that a respondent was in, his or her perceptions of self-efficacy and response efficacy were significantly different. This did not hold for vulnerability and risk severity. Homeowners in the precontemplative decision stage held self-efficacy ratings significantly lower than both contemplatives and action homeowners while there was also a significant difference between action and contemplatives $(F_{1,232} = 7.08, F_{1,232} = 13.55, \text{and } F_{1,232} = 3.55, \text{respec-}$ tively). Homeowners in the precontemplative stage differ from those in the contemplative and the action stages based on their perceptions of self-efficacy and response efficacy, resulting in an increase in riskmitigating behaviors. Similarly, homeowners in the precontemplative decision stage believed that their response efficacy was significantly lower than contemplatives and action homeowners while there was also a significant difference between action and contemplatives ($F_{1,232} = 5.82$, $F_{1,232} = 32.58$, and $F_{1,232} = 16.77$, respectively). The action homeowners have more confidence in their ability to carry out the risk-reduction behaviors than the contemplatives and the precontemplatives. These results are consistent with the literature.(2,15,33)

To summarize the results, the differences that emerge from the regressions for the four PMT variables provide important information for managers and policymakers. First, vulnerability and severity effects are explained by differences solely in subjective knowledge. Second, the differences that occur for selfefficacy and response efficacy result from a combination of subjective knowledge and decision stages. This additional analysis was run to better explain the results presented in Table I and Table II. Next, we discuss the conclusions and implications of these findings.

6. CONCLUSIONS

This study extends the work of numerous researchers who integrated PMT-TTM by investigating the critical influence that homeowners' subjective knowledge can have on the differences in these subgroups.^(2,16,18) Our results confirm that land managers should not view homeowners as one homogeneous group within the same community. Many heterogeneous homeowner segments exist and to effectively communicate with them we must understand both what motivates them and their level of knowledge as it relates to risk. Thus, homeowners who are in the precontemplative stage (both low and high subjective knowledge) as well as low knowledge contemplatives are motivated by perceived vulnerability, which could motivate them to contemplate potential further action if given the right type of "vulnerability-promoting" information. In contrast, the high knowledge contemplatives considering potential behavioral changes are more likely to be motivated by risk severity. This is partially consistent with the extant literature, which finds that contemplatives were more affected by risk severity than perceived vulnerability.^(2,16) Since the high knowledge contemplatives' perceptions of risk severity are significantly higher than those of the precontemplatives, and this group has already undertaken more actions than the precontemplatives, they are more apt to take additional precautions if given effective "risk severity–promoting" information to facilitate that decision, unlike the low knowledge contemplatives.

Finally, the low knowledge action homeowners currently engaged in risk-reduction behaviors to some degree may implicitly believe that they are vulnerable to the negative consequences and that these negative consequences are severe enough to encourage them to act to protect themselves. They are not motivated to act based on the PMT variables mainly because they may be emulating the behaviors of a neighbor or other influential person to mitigate their risk without really having the knowledge to understand the cause-and-effect relationships between riskmitigating actions and the probability of being affected by a wildfire.⁽²⁵⁾ It may be best to use risk communication strategies that provide vivid examples to be followed by such strategies as demonstration plots in highly visible areas of housing associations. This group also lists the smallest number of impediments to undertaking risk-mitigating behaviors. In contrast, for high knowledge action homeowners, increasing the perceptions of risk severity, self-efficacy, and response efficacy rather than focusing on perceptions of vulnerability will lead to greater risk-reduction behaviors.⁽⁶⁾

Involuntary and uncontrollable risks (i.e., as part of "dread risks") are dimensions of risk that can potentially influence human cognitive processes for responding to natural hazards.⁽¹⁴⁾ Neighbors' or agencies' actions (or inactions) are an important factor in the decision-making process for homeowners in taking precautionary measures (e.g., peer pressure, property insurance, frustration with lack of action).⁽³⁵⁾ In addition, other involuntary factors such as drought, weather patterns, the volatility of mother nature (e.g., "no matter what I do, if the big one comes, I am toast") and living in a dense forest location "surrounded by a tinderbox" are all additional reasons given by homeowners for not undertaking risk-reduction actions. These additional aspects of risk responsibility need to be incorporated into future research to better explain why segments of homeowners are more or less likely to protect themselves from the impact of natural hazard risks such as wildfires. For example, whether homeowners have property insurance is definitely a potential critical variable that should be considered in future research. In fact, the qualitative interviews conducted in this research initially found that insurance does not seem to encourage or discourage residents away from undertaking risk-reduction behaviors. Although homeowners realize they can rebuild after a fire, these same homeowners are emotionally attached to their homes and would not want their home to burn, regardless of whether they had insurance or not. Alternatively, some qualitative findings in Brenkert et al.⁽³⁶⁾ support the belief among homeowners for the use of property insurance as a means to encourage residents to mitigate both the community and personal risks from the behaviors of property owners. Future research should measure whether homeowners not only have insurance but the amount of insurance and if this is a differentiating factor.

7. MANAGEMENT AND PUBLIC POLICY IMPLICATIONS

Managerial implications from this research center on understanding the underlying motivation, knowledge of the risks, and the readiness of the affected publics to develop means and methods to effectively communicate with heterogeneous homeowner segments in order to move them closer to the action stage. This involves communicating risk vulnerability and severity, as well as providing recognizable means of effectively responding to the defined risks. People must feel they have the knowledge, ability, and resources to deal with the risk at hand and that the actions they take will effectively reduce the risk, before they are ready to move into the action stage of risk reduction. Managers must be able to present these messages to a variety of diverse segments of homeowners living in the WUI, including culturally, ethnically, and racially distinct groups.

An example of such a targeted approach is found in Ruidoso, New Mexico.⁽³⁷⁾ In this community, demonstrating what should be done, indicating that help is available, and providing that support in a timely and reliable manner considerably increases feelings of self-efficacy and response efficacy and can move people to take action to mitigate fire risks on their property. Such actions have included preparing demonstration plots that show what defensible space should look like. Other activities include property assessments to recommend what types of risk-reduction measures should be taken by individuals, providing free pick-up and hauling for thinned materials, free or low-cost chipping for thinned materials, and burn pits for those materials, among others.

Perhaps the best advice for managers is to define the different homeowner segments in a public land manager's district or region. By developing an indepth description and understanding of these potentially diverse segments, managers are better equipped to develop a strategy to effectively communicate with homeowners in the WUI. Many times, gatekeepers or leaders in the WUI communities possess considerable information about their community, and managers need to better tap into these leaders to build upon the existing relationships, develop new relationships, and cultivate those resources. In addition, observing the degree of risk-mitigating behaviors that have occurred among subgroups in a community is also critical information. The manager can target risk communication information in the most effective way based on developing a thorough understanding of a target segment's degree of motivation, previous riskmitigating behaviors, and the level of knowledge to increase the probability of undertaking additional riskreduction behaviors. Research has shown that targeted one-on-one information that is designed to address the issues of particular property and physical characteristics of an area is more likely to move people to mitigate the risks of wildfire.⁽³⁶⁾ General information disseminated in the form of pamphlets and presentations at town meetings, etc. have not been found to motivate homeowners to take action. These are important lessons that managers must keep in mind when developing a risk communication strategy for residents in their surrounding communities.

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APPENDIX

Risk-Reduction Behaviors

- Creating a minimum 30-foot defensible space around your home
- · Planting low-growing, fire-resistant plants around your home
- · Putting a fire-resistant roof on your home
- Putting fire-resistant undersides to any decks and balconies on your home
- · Removing any dead branches from your home's roof and around the chimney
- · Making sure that your home is easily identifiable and accessible from a main road
- · Making sure that all the trees on or near your property are away from structures
- · Making sure that all the trees on or near your property are away from overhead utility lines
- Working with neighbors to clear common areas and prune areas of heavy vegetation
- Stacking firewood and scrap wood piles at least 30 feet from any structure, and
- · Getting local fire department to do a fire safety inspection at your home and property.

Source: Firesafe Council of California website: www.firesafeco uncil.org

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