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Making the Decision to Mitigate Risk

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Why individuals choose to mitigate, downplay, or ignore risk has been a topic of much research over the past 25 years for natural- and human-created risks, such as earthquakes, flooding, smoking, contraceptive use, and alcohol consumption. Wildfire has been a relatively recent focus in the natural hazard literature, perhaps a result of several 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. To mitigate or reduce the risks of wildfires to communities and homeowners in the WUI requires action across the landscape, which includes treating both public and private lands. Significant 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; additionally, the area that determines the home ignition zone during extreme wildfires occurs largely on private lands (Cohen 2004). Yet many homeowners do not undertake mitigating actions to protect their homes and potentially their lives from the risks of wildfire.

This chapter investigates the cognitive perceptual process that homeowners experience when faced with the decision of whether to protect themselves from the risk of wildfires. This decision can be explained through two complementary theories: protection motivation theory (PMT) and stage theories such as the transtheoretical model (TTM). PMT states that some form of risk information can provide the impetus for individuals to determine the degree of risk severity, their vulnerability, and their ability to reduce that risk. Stage theories

categorize the decisionmaking stages that individuals go through when exposed to risk information—whether through actual experience with the risk or through indirect experience, such as from brochures or videos. We integrated these two theories to investigate when homeowners are more or less likely to reduce their risk of being impacted by wildfire (Block and Keller 1998; Weinstein and Sandman 1992).

To further enhance our understanding of human response to wildfire risk and effective risk communication, we explore how PMT and TTM can be combined to explain homeowners' behavior. A discussion of these two theories in conjunction with other related theories provides the foundation for a set of hypotheses. A description of the methodology used to test the hypotheses follows, along with the data analyses and results. After a discussion of the results as they relate to our theoretical conceptualization, we present a set of unanswered questions to provide a basis for a research agenda. Finally, we discuss the managerial implications of our work.

Protection Motivation Theory

Protection motivation theory states that stakeholders' motivations or intentions to protect themselves from harm are enhanced by four critical cognitions or perceptions: the severity of the risks, personal vulnerability to the risks, self-efficacy or confidence in one's ability to perform the risk-reducing behavior, and the response efficacy of the risk reduction behavior (Rogers 1983). It also posits that people's intentions to protect themselves are weakened by the perceived costs of the risk-reducing behaviors and the perceived benefits of the alternative risk-enhancing behaviors. PMT is organized as two mediating sub-processes that consumers use in evaluating threats (threat-appraisal process) and selecting among coping alternatives (coping appraisal). Assessments of threats (severity, vulnerability, and benefits) and coping factors (self-efficacy, response efficacy, and costs) combine to form a motivation in stakeholders to protect themselves from the risk. Protection motivation arouses, sustains, and directs activities, starting with the identification of a natural hazard such as wildfire in the WUI (Mulilis and Lippa 1990; Rüstemli and Karanci 1999).

According to PMT, people can be motivated to engage in desirable health behaviors not only to avoid health risks, but also to avoid social or interpersonal risks (Pechmann et al. 2003). The research in PMT has focused on the impact of health information (such as antismoking messages) on the elicitation of the appraisal of both the threat and the coping techniques (e.g., Floyd et al. 2000; Mulilis and Duval 1995; Rippetoe and Rogers 1987). People use the threat-appraisal process to evaluate potentially harmful responses, such as refraining from doing something to protect oneself and one's home from the risk of wildfire (maladaptive response). The intrinsic and extrinsic rewards or benefits (such as "I enjoy my trees") will increase the probability of a maladaptive

response ("It costs too much to create a 30-foot defensible space around my home"), whereas threat will decrease the probability. In contrast, the severity of the risk and personal vulnerability to the danger will decrease the probability of a maladaptive response, whereas the response cost will increase the probability of an adaptive response (such as creating defensible space around one's home). This theory has been used to explain the effects of risk communications on health and natural hazards (e.g., Block and Keller 1998; Mulilis and Lippa 1990; Pechmann et al. 2003; Weinstein 1989).

In the case of wildfire risks, the likelihood of an individual being impacted by the risk of wildfire is decreased and the probability of an adaptive response increased by belief in the high severity of the wildfire risk, in the high vulnerability of both physical property and health to the risk, that defensible-space behaviors are an effective way to mitigate the risk of wildfire, and that one can successfully avoid the risk of wildfire. In contrast, the likelihood of not doing anything about the risk of wildfire is increased by intrinsic rewards (such as enjoying your trees and privacy), extrinsic rewards (peer approval from neighbors who believe the same way as you do about the beauty of the forest), and the costs of an adaptive response (creating and maintaining defensible space on your property). The increased likelihood of an adaptive response (creating defensible space) depends primarily on the four cognitive perceptions of severity, vulnerability, self-efficacy, and response efficacy. The degree of these cognitive perceptions can enhance the persuasive effects of a risk communication strategy that elicits protection motivation. By eliciting a desire to protect oneself and one's property, the risk information can then arouse, sustain, and direct activities for self-protection, such as increasing the number of defensible-space behaviors, working to reduce some of the involuntary risks created by neighbors, and maintaining these risk-mitigating behaviors over time. Strong beliefs in severity, vulnerability, 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.

Varying Levels of Readiness to Mitigate Risks

PMT does not assume that the decisionmakers are rational or unbiased. Each of the cognitive appraisal processes can be biased by a heuristic judgment. In the psychological risk paradigm, researchers have demonstrated that people use mental heuristics to evaluate risk (e.g., Kahneman and Tversky 1979; Slovic 1987; Tversky and Kahneman 1973; Viscusi 1990). This research has demonstrated repeatedly the difficulties that individuals have in understanding probability, biased media coverage, misleading personal experiences, and more, leading to the over- and underestimation of risk perceptions. Slovic (1987) describes a number of dimensions to risk (such as dread and unknown) that cause perceptions to vary across people, experiences, and characteristics.

This research has brought attention to the multiple dimensions of risk and the fact that individuals respond differently depending on the type of hazard, its characteristics, and the individual.

We introduce a potential factor that may explain the varying motivations for people to reduce their risks. The degree of readiness to accept and act on a risk can impact their particular motivational level to protect themselves and their property. Stage theories have been used to examine health behavior change based on the assumption that predictor variables will influence different people in different ways (Horwath 1999). These theories specify an ordered set of categories into which people can be classified. Based on this categorization, one can identify the factors (such as vulnerability or risk severity) that can induce movement from one stage to the next (Weinstein et al. 1998). 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 decisionmaking stages that an individual faces when exposed to a health risk message: precontemplation, contemplation, preparation, action, maintenance, and termination. People are assigned to one of the six stages on the basis of their behavior and intentions for future actions (Prochaska et al. 1994).

Numerous health behavior theories, such as PMT and the Health Belief Model (HBM), specify factors (such as response efficacy and vulnerability) that produce transition between the stages. For example, Block and Keller (1998) found that people are at different stages of readiness to undertake risk reduction behaviors, which can in turn be affected by the four cognitive processes in PMT. 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 risk severity, vulnerability, self-efficacy, and response efficacy are critical motivators as people move through the stages of precontemplation, contemplation, and action.

Precontemplation Stage

Individuals in the precontemplation stage (precontemplatives) are resistant to change and often either do not see or will underestimate the risk of a particular hazard. For example, a review of the hazard risk perception literature found that overall, people are optimistic about the risks, perceiving them to be lower than they actually are (Weinstein 1987). A number of studies have indicated that residents tend to deny the risk of natural disasters by discounting the possibility that anything serious will ever happen to them (Burton and Katès 1964; Mileti et al. 1975). Additionally, people may be reluctant to acknowledge higher perceived risks if they provoke feelings of anxiety (such as because of their uncontrollability), thereby denying the existence of the risk (Lazarus and Folkman 1984). In this stage, homeowners living in the WUI must first accept that they are vulnerable to the risk of wildfire before they can consider engag-

ing in any risk reduction behaviors. Thus at this level of readiness, the focus should be to increase their perceived vulnerability to the risk of wildfire.

H1: Higher perceptions of vulnerability will be more strongly associated with intentions to perform risk reduction behaviors among precontemplatives than will risk severity, response efficacy, and self-efficacy.

Contemplation Stage

Individuals in the contemplation stage (contemplatives) have moved forward to acknowledge that there is a problem, but they do not have concrete plans of action in the next six months or so. This group believes that they are vulnerable to the risk of wildfire and thus are considering risk reduction behaviors. Block and Keller (1998) believe that consumers in this stage of readiness need a risk communication message that emphasizes the severity of the hazard to motivate them to take mitigating actions. Research in health communication focuses on a particular category of risks, such as cancer or sexually transmitted diseases (STDs). In the natural hazards area, risk, such as wildfire, has different characteristics that have implications for the means by which contemplatives will perform recommended behaviors. For example, the hazard literature indicates that the link between risk perceptions and preparedness behavior is at best tenuous (McCaffrey 2004a; Tierney 1993). It could be that high awareness levels are necessary for action but that other factors are also important in motivating homeowners toward action. Possibly, increasing homeowners' feelings of vulnerability along with increased levels of risk severity will motivate them toward taking more action to protect themselves. For example, in Mileti and Sorenson (1987), respondents may have been in the contemplation stage as high perceptions of vulnerability and risk severity from a natural hazard increased their likelihood of mitigating the risk. We posit that for homeowners contemplating taking risk-mitigating actions, the combination of both perceptions of vulnerability and severity are needed to motivate them to take action to protect themselves.

H2: Higher perceptions of vulnerability and risk severity will be more strongly associated with intentions to perform risk reduction behaviors among contemplatives than will response efficacy and self-efficacy.

Action Stage

Finally, those in the action stage (action homeowners) are in the process of taking or have already taken action to reduce their risk through specific behaviors. Past research in the health behavior literature found that self-efficacy increased significantly in the action stage (Rossi et al. 1994; Sporny and Contento 1995). Thus individuals need the confidence to undertake the critical risk reduction

behaviors along with a belief that these behaviors will be effective (self-efficacy and response efficacy). This also implies that varying levels of personal vulnerability and risk severity will not differentially affect homeowners' need to protect themselves. Instead, the focus becomes using interventions that will increase homeowners' confidence and belief that they can successfully undertake the most effective risk reduction behaviors.

H3: Higher perceptions of response efficacy and self-efficacy will be more strongly associated with intentions to perform risk reduction behaviors among action homeowners than will vulnerability and risk severity.

It is possible that for the action homeowners, increasing perceptions of vulnerability and risk severity could actually lead to a "boomerang effect" (Pechmann et al. 2003). In this situation, homeowners who are confronted with extremely high perceptions of vulnerability and risk severity may instead revert to denial, thus reversing their behaviors to mitigate the risks. It becomes important to ensure that this group believes in their ability to undertake effective risk-mitigating actions, or as Pechmann et al. predict, they could revert to doing nothing, given the perceived uncontrollability of the risk of wildfire.

Methods

To test our hypotheses, we focused on communities 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; the third had a more distant and not as severe history with wildfires. Homeowner association lists were obtained for all three communities. All residents of the communities, both part- and full-time, were sent a survey that included the measures described below. 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 three weeks after the first mailing.

Before sending out 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 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 wildfires that had affected the areas, and any other issues or problems that were specific to a community. The participants in the focus groups were selected because they were seen as more active in their communities and more willing to discuss their communities' history and wildfire history with us. This provided a more in-depth understanding of each community. In addition, the participants in these focus groups were given the survey. We compared the results from the

focus group survey participants with the responses to the mail survey for each community to determine whether there was any nonresponse bias (Alreck and Settle 1995). Based on a set of t-tests on a subset of the risk perception, self-efficacy, and response efficacy measures, we found no significant differences between the two.

Sample

Prior research has used both environmental factors and health communication sources to effect the protection motivation process and initiate behavioral change (e.g., Floyd et al. 2000; Pechmann et al. 2003; Rogers 1983). We focus on the communities' experience with wildfire as well as their location in the wildland-urban interface as the environmental source of information. In total, we ended up with 238 out of 423 completed and usable surveys from all three communities, with a response rate of 57 percent. The locations were small communities in central Colorado, northern Colorado, and central Oregon. A description of each community is provided to give a clear picture of the critical characteristics for each group.

Central Colorado. The first location, in central Colorado, is adjacent to and surrounded by the Pike National Forest. In June 2002, the Hayman fire burned over 138,000 acres northwest of this community. Almost 70 percent of the homeowners were evacuated when the fire came within five miles of the community. This community has had significant experience with wildfire, including evacuation, smoke impacts, and frequent exposure. The community is composed of only full-time residents, with the majority having lived in the area for more than 10 years, although about a quarter moved into the area less than 5 years ago. The homeowners who completed our survey were 35 years and older, with more than 55 percent over 55 years of age, making it primarily a retirement community. This group was highly educated, with 65 percent having at least a college degree, and fairly affluent, with 85 percent citing a yearly household income over \$50,000.

Northern Colorado. The second location, in northern Colorado, is a community completely surrounded by the Roosevelt National Forest. Although these homeowners have seen a few fires in the past 10 years, none warranted their evacuation. This community represents an emerging retirement area, with 63 percent of the homeowners over the age of 55. Of the respondents, 60 percent were male, and 82 percent of the sample had attained at least a college degree. This community is also fairly affluent, with 62 percent earning more than \$50,000 per household per year.

Central Oregon. The third community, in central Oregon, is surrounded by the Deschutes National Forest. This community was evacuated twice during

the B&B Complex fire, which included both the Bear Butte and Booth fires. The Oregon homeowners were an older sample, with 60 percent over 55 years of age. They were highly educated, with 75 percent of the respondents having at least a college degree. Approximately 50 percent were part-time residents, and 58 percent were male. The community is fairly affluent, with 57 percent citing a yearly household income over \$75,000.

Independent Measures

In order to determine the effect of the cognitive processes on behaviors and behavioral intentions, we measured homeowners' risk perceptions, response efficacy, and self-efficacy.

Risk Perception Measures. In protection motivation theory, risk severity and vulnerability are the critical risk perception measures. Risk severity is defined as the amount of hardship that would occur if one experienced the risk. We measured risk severity using two seven-point Likert scales, ranging from 1 = not at all serious/no harm at all to 7 = extremely serious/extremely devastating ($\alpha = 0.87$). The respondents rated the following two questions according to this scale: "How serious do you feel the negative consequences of wildfires are to you personally?" and "How severe will the impact of a wildfire be where you live?" Risk vulnerability is defined as the likelihood of harm if there is no change in behavior. We measured this criterion using two seven-point Likert scales by asking, "How vulnerable do you feel about the possibility of a wildfire physically affecting you or your family? Your property or possessions?" Respondents rated these questions from 1 = not at all vulnerable to 7 = extremely vulnerable ($\alpha = 0.78$).

Response Efficacy Measures. Response efficacy is defined as the degree to which a proposed risk mitigation behavior is effective at reducing a particular risk. Respondents were asked to rate the effectiveness of 11 risk reduction behaviors (see Table 7-1) by answering the question "How effective are the following actions at helping to reduce the risk of fire impacting your property and lives?" using the scale of 1 = not at all effective to 7 = very effective. These 11 measures were combined into a composite measure by calculating their mean score for each respondent of response efficacy.

Self-Efficacy Measures. Self-efficacy is defined as the belief that one is capable or not capable of performing a risk mitigation behavior (Bandura 1977). To measure self-efficacy, respondents were asked, "How confident do you feel in your ability to do the following [risk reduction behaviors]?" and "How confident do you feel in general about your ability to protect yourself and your property from wildfire?" They rated each from 1 = not at all confident to 7 = very confident. These 11 measures were combined into a composite

TABLE 7-1. Risk Reduction Behaviors

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- 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 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
 - Contacting your local fire department to get a personal fire safety inspection at your home and property
-

Source: Firesafe Council of California (2004).

measure by calculating their mean score for each respondent of self-efficacy (see Table 7-1).

Additional Measures. Some additional measures were asked to obtain a better understanding of what motivates people to protect themselves against the risk of wildfire. These were designed to provide further support for the results of our initial analyses and included measures of the biggest impediment to protecting oneself (response costs) and demographic information. We asked respondents to explain the biggest impediment they faced when deciding to take some protective action on their property. This was an open-ended question that allowed respondents to write down one or more reasons that they felt were critical in determining whether to protect their property. Two researchers coded the responses into categories independently. The coders were blind to our hypotheses, with a resulting set of 11 categories of cited impediments. Finally, we ended the survey with a set of demographic questions that asked respondents to identify their age, gender, education, primary residence, how long they had lived there, and income. To determine whether respondents had a second home in the community, they were asked to state how much time they spent at the residence and how long they had lived there.

Dependent Measure: Behavioral Intention

The dependent measure of interest in PMT and our research is behavioral intention, or the amount of risk reduction behaviors that homeowners engage in to protect themselves from the risk of wildfire. 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 risk mitigation behaviors. We measured the behavioral intentions and actions that respondents could take to protect themselves against the risk of wildfire, using the Firesafe Council of California's list of 11 risk reduction behaviors (see Table 7-1). Each behavior was measured using the following scale: 1 = already done, 2 = will do in next month, 3 = will do in next three to six months, 4 = will do next year, and 5 = will not do. The 11 measures were combined into a continuous composite measure ranging between 1 and 5 for behaviors and behavioral intentions.

Categorization into Decision Stages

In order to classify respondents into one of three possible decision stages, we used the number of actual behaviors that they undertook to mitigate their risk, again based on the 11 potential risk reduction behaviors listed in Table 7-1. A frequency distribution was run on categories for the composite behavior measure. The resulting trimodal distribution was used to categorize respondents as precontemplatives, contemplatives, or action homeowners ($n = 58, 86, 94$, respectively). Individuals were categorized as being in the action stage if they had already completed seven or more behaviors. They were categorized as precontemplatives if they answered "will not do" for five or more behaviors. All those who did not fall into the action or precontemplative categories were classified as contemplatives. The resulting decision stage measure was a count categorical variable ranging from 1 to 3.

Analyses and Results

From the three communities, a total of 238 homeowners participated in the survey research. First we conducted a set of contrasts to determine if significant differences existed in terms of risk reduction behaviors for these three communities. Because the results demonstrated that there was no significant difference among the three communities, we combined all respondents into one group. Subsequently, an overall regression equation was estimated for the entire sample, using behavioral intentions as the dependent variable with the same four independent variables. The regression analysis indicated significant beta coefficients for all four predictor variables (last column of Table 7-2). Therefore, respondents were categorized into one of the three groups based on the decision stage categorization scheme described above to investigate the differential impact of the decision stages on the psychological PMT measures. The results from the overall regression equation are consistent with some previous studies in PMT (e.g., Pechmann et al. 2003), whereas other

TABLE 7-2. Beta Coefficients, Standard Errors, and p-Values for Behavioral Intentions Regressed on Vulnerability, Risk Severity, Self-Efficacy, and Response Efficacy

	Decision stage ^a			
	Precontemplation	Contemplation	Action	Overall
Vulnerability	-0.42* (0.04)	-0.15* (0.04)	0.02 (0.04)	-0.12* (0.04)
Risk severity	0.03 (0.04)	-0.08* (0.04)	-0.12* (0.05)	-0.10* (0.05)
Self-efficacy	0.02 (0.02)	-0.09 (0.06)	-0.12* (0.05)	-0.13* (0.06)
Response efficacy	0.05 (0.05)	-0.01 (0.06)	-0.15* (0.06)	-0.28* (0.06)
n	58	86	94	238
R ²	0.71	0.34	0.28	0.33

Notes: * $p < 0.001$. Degrees of freedom: 4, 233 for the overall model and 4, 57; 4, 85; 4, 93 for each of the main effects, respectively. The values in parentheses are standard errors related to each of the beta coefficients.

^a The behaviors for the decision stages were coded as follows: 0 = already done, 1 = will do in next month, 2 = will do in next three to six months, 3 = will do in next year, 4 = will not do.

studies have resulted in different patterns (e.g., Block and Keller 1998; Maddux and Rogers 1983).

Testing of Hypotheses (H1 through H3)

As seen in Table 7-2, the result for the first regression for precontemplatives demonstrates that the only significant predictor of behavioral intentions (coping response) was perceived vulnerability, which is consistent with H1. For precontemplatives to consider mitigating their risk and moving to the next decision stage, they must first feel vulnerable to the risks of wildfire. The second regression for contemplatives indicates the significant predictors of behavioral intentions (coping response) are perceived vulnerability and perceived risk severity, providing support for H2. For contemplatives, increasing feelings of vulnerability leads to greater intentions to engage in risk reduction behaviors. What differentiates precontemplatives from contemplatives is the importance of risk severity to the latter group. To move the contemplatives to the next decision stage, they must experience increased levels of risk severity. For example, homeowners must believe that severe impacts will occur from a wildfire, perhaps from an ongoing drought. Consistent with H3, the significant predictors

of self-efficacy and response efficacy confirm their influence on behavioral intentions (coping response) for the action homeowners (see Table 7-2). Thus action homeowners need to believe that they have effective means to reduce the risks and vulnerabilities associated with wildfire. The unexpected result for the action phase was that risk severity was also significant. Overall, these results demonstrate that the three groups of homeowners are differentiated based on what is critical to move them from one decision stage to the next.

To obtain a better understanding of why homeowners in the various decision stages were differentially likely or unlikely to undertake risk reduction strategies, we asked them to state factors that affected their decision on whether to undertake risk mitigation actions. Table 7-3 shows the different reasons homeowners give for their unwillingness to undertake risk mitigation

TABLE 7-3. Biggest Impediment by Decision Stage

	<i>Decision stage</i>			
	<i>Precontemplation</i>	<i>Contemplation</i>	<i>Action</i>	<i>Total responses</i>
1. Cost	12	11	11	34
2. Time	6	12	3	21
3. Others pose risks	5	5	9	19
4. Only so much one can do	6	6	5	17
5. Aesthetics	7	5	5	17
6. Forest Service mismanagement poses risks	2	7	7	16
7. Wildfire is uncontrollable	3	4	5	12
8. Mother Nature	1	5	4	10
9. Age and physical ability	1	3	5	9
10. Vacation home	3	3	1	7
11. No impediments	1	4	8	13
Total impediment responses	47	65	63	175
n	58	86	94	238

Note: Numbers in columns indicate number of times each response was stated.

behaviors. (Note: The discussion based on the results in this table is not meant to be explanatory, but only to provide some qualitative explanations for homeowners' unwillingness to undertake risk mitigation behaviors.)

There were more similarities across the three decision stages and few differences related to respondents' stated biggest impediment. The most important similarity across all three groups was that cost was considered a big impediment to protecting oneself and one's property from the risk of wildfire consistent with PMT. With regard to differences, time was cited as the biggest impediment by more respondents in the contemplation stage than in the other two. In addition, more action homeowners cited no impediments to engaging in risk reduction behaviors, which is what one would expect given that this group has undertaken more risk reduction behaviors. Finally, the contemplatives and action homeowners cited involuntary risks, such as "Forest Service mismanagement poses risk," "Mother Nature is unpredictable," or "wildfire is uncontrollable," more often than precontemplatives as the biggest impediments. It is important to keep in mind that the discussion here is based on a qualitative analysis with the intent of providing some in-depth descriptions of what could affect their decisions on fire risk mitigation.

This is consistent with the PMT model, because homeowners in the precontemplation stage are not motivated by either efficacious measures or uncontrollable factors to move from the precontemplation to the contemplation stage. These homeowners 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.

To confirm if PMT integrates with the TTM, we investigated the differences in PMT variables by the decision stages to determine whether a positive linear trend existed for the four predictor variables. This would verify the differences among the precontemplation, contemplation, and action decision stages for vulnerability, risk severity, self-efficacy, and response efficacy (see Table 7-4). The results indicate a positive linear trend for four of the five PMT measures. Consistent with Block and Keller (1998), we found support for the positive linear trend for self-efficacy. The action homeowners have more confidence in their ability to carry out the risk reduction behaviors than the contemplatives and precontemplatives. The significant linear trend from precontemplatives to action homeowners confirms that action homeowners have completed more risk reduction behaviors than the contemplatives, who have completed more than the precontemplatives.

Consistent with Weinstein and Sandman (1992), we found a significant positive linear trend for risk severity and response efficacy. Weinstein et al. (1998) found that perceived severity is a strong predictor of action decisions; this is exemplified in Table 7-4; where the rating of risk severity is highest with the action group. Finally, the linear trend analysis for vulnerability was not significant; this was not consistent with Block and Keller (1998).

TABLE 7-4. Means, Standard Deviations, and F-Statistics for Linear Trend for PMT Variables across the Four Decision Stages

	Decision stage			Linear term F-statistic
	Precontemplation	Contemplation	Action	
Vulnerability	5.05 (1.46)	5.33 (1.29)	5.19 (1.40)	F = 0.72
Risk severity	4.64 (1.39)	5.44 (1.46)	5.50 (1.19)	F = 8.35*
Self-efficacy	5.21 (1.01)	5.70 (0.91)	6.02 (0.73)	F = 15.60*
Response efficacy	5.11 (1.02)	5.69 (1.04)	6.22 (0.63)	F = 28.17*
n	58	86	94	

Note: * $p < .001$

Interestingly, the vulnerability means actually decrease when moving from the contemplatives to the action homeowners. This could be due to the action homeowners' perceptions about the effectiveness of risk reduction measures, which are influencing their perceptions about vulnerability; in other words, because these action homeowners have already undertaken a fair number of risk-mitigating behaviors, they feel that their actions have mitigated some of their vulnerability. This is not the case with risk severity, which is a clear motivator for the action homeowners.

Finally, consistent with past research, we have demonstrated that homeowners move from the precontemplation to the action stage as their perceived risk severity, self-efficacy, and response efficacy increase. As homeowners move from the precontemplation to the contemplation stage, their perceptions of vulnerability, risk severity, self-efficacy, and response efficacy increase, but the differences are not significant.

In conclusion, this research supports the work of numerous researchers to integrate protective motivation theories into stage theories to develop a more process-oriented understanding of why some individuals attend to risks and others discount risk (Block and Keller 1998; Weinstein et al. 1998). Our results confirm that homeowners who are in the precontemplation stage are motivated by perceived vulnerability, which leads them to contemplate potential further action if given the right type of vulnerability-promoting information. Likewise, those contemplating whether they should change their behavior to mitigate the risk are motivated primarily by perceptions of vulnerability and risk severity.

This is partially consistent with the extant literature, which found that contemplatives were more affected by risk severity than perceived vulnerability. Given that contemplatives' perceptions of risk severity are significantly higher than those of precontemplatives, this group has already undertaken more actions and is more apt to take still more precautions if given effective risk-severity-promoting information to facilitate that decision. Another difference between the contemplatives and the other two groups is related to their determination that time is the biggest impediment to whether they will undertake a risk-mitigating behavior. Additionally, the precontemplatives often attribute their inaction to a desire to maintain certain aesthetics around their home, as well as the belief that there is only so much one can do to reduce the risk. Our model, which provides additional support for the literature, would indicate that increasing these homeowners' perceptions of vulnerability and risk severity will increase their self-protective behaviors.

Finally, homeowners currently engaged in risk reduction behaviors to some degree already believe that they are vulnerable to negative consequences that are severe enough to encourage them to act to protect themselves. For 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 (Weinstein and Sandman 1992). Related to the stages in the TTM, research in this area has focused on a single-act criterion to mitigate the risk. In our research, we look at a composite measure of 11 risk-reducing behaviors, which extends the work of Prochaska and others in stage theories.

Additional Considerations and Some Unanswered Questions

We have alluded to the importance of risk communication throughout this chapter. In this research, we look at the integration of PMT and TTM at one point in time across the three groups. We do not look at the impact of an intervention on movement across stages, as past research does. Future research should address how various types of interventions, such as informational literature, websites, education forums, and demonstration sites, can help move homeowners across decision stages to reduce their risk associated with wild-fire or other natural hazards. It is important to understand how risk communication can and should be tested in the integrative PMT-TTM approach to take this research the next step. By understanding how to communicate in an effective way to different segments of homeowners (precontemplatives, contemplatives, action homeowners), we can help provide solutions to improving the probability that each segment will engage in risk-mitigating behaviors.

Traditionally, the health communication literature has used the PMT-TTM through a pre-post-test experimental design framework to examine the effects

of various types of information on risk reduction behaviors. This study has demonstrated that homeowners at different levels of readiness respond to and are motivated by a series of cognitive processes. To extend the findings in this study, the next step would be to introduce risk information that addresses these cognitive processes. We would predict that the risk information that focuses on increasing perceptions of vulnerability would be effective at moving precontemplatives into the contemplation stage; information that focuses on vulnerability and risk severity would move contemplatives to the action stage; and information on risk severity, the effectiveness of mitigating behaviors, and means by which homeowners could reduce their risk would result in action homeowners undertaking more mitigating behaviors.

This research focused on three of the six TTM decision stages: precontemplation, contemplation, and action. The complete transtheoretical model proposes six decisionmaking stages that an individual faces when exposed to a health risk message: precontemplation, contemplation, preparation, action, maintenance, and termination (Prochaska et al. 1994). Further research needs to extend the segments of homeowners to include an examination of two of the three remaining decision stages: preparation and maintenance. (Given the ongoing nature of the risk of wildfires and living in the WUI, termination is not a meaningful decision stage for homeowners.) Investigating homeowners' understanding of and motivation for maintaining their defensible-space actions over time—the maintenance decision stage—would be an obvious extension of this research.

In order to better understand the causal relationships between the psychological variables of Protective Motivation Theory and behaviors and behavioral intentions within a stage theory framework, future research should test these relationships in a structural equation framework. By verifying the causal relationship between these variables, strategies to ensure that individuals will protect themselves from risks can be more effectively implemented. For example, could the homeowner inflate perceptions of self-efficacy in order to justify or rationalize the decision to put a fire-resistant roof on his or her home or do other risk-mitigating behaviors? This needs to be investigated in future research.

The impact of subjective knowledge on the PMT model needs to be investigated to address the prevalent belief in the natural hazard and wildfire risk literature that people are knowledgeable about the high risks of wildfire but still do little or nothing to mitigate it. The role of subjective knowledge, especially erroneous beliefs about hazards such as wildfire, is an important issue (c.f. Whitney et al. 2004). Homeowners' subjective knowledge (self-rated knowledge level) is based on their direct experience (such as whether they were evacuated or lost property as a result of a fire) and indirect experience (such as reading information or hearing from experts or by word of mouth) with a particular category of interest, such as wildfire (Alba and Hutchinson 1987). Personal experience can have a powerful impact on the recognition of risk and the willingness to

protect oneself from the risk (Weinstein 1989). An understanding of homeowners' personal experiences can provide input into effective risk communication. Insight into the factors that motivate stakeholders to protect themselves against risks is dependent on an individual's direct and indirect experience, which is often the basis for their subjective knowledge on the topic. These past experiences become the foundation for individuals' beliefs in their own knowledge about a risk (Alba and Hutchinson 1987). The extant literature on knowledge has consistently demonstrated that experts have much greater awareness and knowledge about a particular risk and alternative strategies to deal with that risk (Mitchell and Dacin 1996). In contrast, less knowledgeable homeowners tend to recall less information related to the risk, and their knowledge tends to be episodic; in other words, causal relationships between defensible-space actions and reducing their vulnerability and the severity of the risk are missing.

Additionally, a significant number of the homeowners in our sample are part-time, or second-home, residents. In our focus groups, discussions with primarily full-time homeowners resulted in a common complaint about part-time residents. These second-home residents were viewed as creating much of the involuntary risk that full-time residents face, as they were seen as less likely to undertake mitigating actions on their properties, thus putting the full-time residents at a greater risk (Integrated Resource Solutions 2004). Further, many of the communities at risk from the impact of wildfires are experiencing rapid population growth, which in some locations includes a recent significant increase in part-time home ownership. One report analyzing the impacts and demographics of five counties in the Rocky Mountain Region of central Colorado found that approximately 60 percent of homes in this region are second homes (see Lichtenstein 2004). Incorporating this dynamic into the PMT-TTM process could offer risk communication insights for land managers, community organizers, and homeowner associations in working with this segment of homeowners.

The timing of a catastrophic natural hazard can affect perceptions of vulnerability and risk severity. For example, hazard research has found that perceptions of vulnerability and risk severity are higher after an extreme event and then wane over time (Lindell and Perry 2000; Sims and Baumann 1983; Weinstein 1989). Two of our three communities were sampled approximately six months after a large-scale wildfire. Also, recurring fires were experienced in these areas, and many homes were evacuated. Future research should explore the temporal and spatial dimensions of wildfire experience, subjective knowledge, and decision stage on the PMT model, which would help address the question of what happens to homeowner perceptions and actions when the rains come and the current drought is not as apparent.

Involuntary and fatalistic aspects and impediments for reducing risks form another theme that is pervasive in our qualitative research (Bender et al. 2003; Integrated Resource Solutions 2004). Involuntary risks, as part of "dread risks," have been demonstrated as a dimension of risk that can potentially influence

human cognitive processes for responding to natural hazards (Slovic 1987). Neighbors' or agencies' actions or inactions (peer pressure, frustration with lack of action) are an important factor in homeowners' decisionmaking process over whether to take precautionary measures. Additional reasons given by homeowners for not undertaking risk reduction actions include other external sources of risk, such as drought, weather patterns, the volatility of Mother Nature ("No matter what I do, if the big one comes, I am toast"), or living in a dense forest location "surrounded by a tinderbox." External attribution and fatalistic responses to risk and the related concept of responsibility need to be further explored and explicitly examined to model why segments of homeowners are more or less likely to protect themselves from the impact of natural hazard risks such as wildfires.

Finally, the effects of social and cultural variables on risk perception, risk communication, and response require further examination. This topic is discussed in the natural hazard literature, as well as in the body of work on risk analysis (Flynn et al. 1994; Lindell et al. 1980; McCaffrey 2004a, 2004b; Plough and Krinsky 1990). There is empirical evidence that ethnic minorities vary systematically in ways that affect the process and outcomes of risk communication, although the number of studies is small (Lindell and Perry 2004). Very little work has been done on the effects of culture, ethnicity, and race on risk perception and response when it comes to wildfire. This topic is indeed an important one that must be pursued in future research. Future studies in this area must go beyond simple reporting of differences that appear to be cultural in origin. Model-based, cross-cultural studies seeking underlying causal variables are needed (Weber and Hsee 1999). Education, income, age, and years of residence in the United States, for example, have been suggested as variables of interest (Winter and Cvetkovich 2003). The increased understanding provided by determining which aspects of cultural variation may be causing possible differences in perceptions and behaviors can give managers an enhanced capacity to understand and work with distinct cultural, ethnic, and racial groups. For example, accommodation theory would suggest that the more effort managers put into trying to communicate risk effectively with an ethnically diverse community, the more positive the response should be from that community (Koslow et al. 1994).

Management Implications

Management implications from this research center on understanding the readiness stages of the affected publics and developing means and methods to move them into 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 that they have the knowledge, ability, and resources (self-efficacy) to deal with the risk at hand, and that the

actions they take will effectively reduce the risk (response efficacy), before they are ready to move into the action stage of risk reduction. Information on how, when, and what to communicate to move the public to the stage of risk reduction action is of considerable importance to public land managers charged with implementing fire risk reduction programs. This section will initially focus on the effective messages for communicating for the three segments of homeowners. Then the discussion will turn to important ideas and findings from sociocultural research that has targeted various populations to help to answer the question of how and when to communicate with segments of at-risk homeowners.

What to communicate addresses the crucial topic of moving members of the public to the action stage of addressing and reducing fire risk. Presenting information and messages that affect homeowner beliefs about wildfire vulnerability and risk severity as well as about self-efficacy and response efficacy are all options for managers. Our model indicated that overall, homeowners are motivated by all four psychological factors. When the sample is divided into various stages of readiness in addressing the threat of wildfire, however, a different picture emerges.

Homeowners in the precontemplation stage are motivated by vulnerability to the wildfire risk. For fire managers who interact with the private landowners, the message for this type of homeowner is simply that the home or structure is highly vulnerable to wildfire. A message that portrays a home's vulnerability could explain fire behavior: how crown and ground fires can burn houses (Cohen 2004) and the high frequency of fire return intervals for many of the WUI areas. Homeowners who are further along at undertaking some risk reduction actions but are contemplating additional actions are motivated by messages of wildfire risk severity as well as vulnerability. Perhaps homeowners in this segment would respond to one-on-one communication that focuses on the severity of the drought and insect situation and how these conditions will create the possibility of a catastrophic outcome for communities in the WUI. Using the fire risk dial in and around communities may be another way to actively communicate risk severity.

For homeowners in the action segment, fire managers should not oversimplify the problem, as these individuals are motivated by risk severity as well as feelings of self-efficacy and response efficacy. This caution is especially important when attempting to encourage those in the action stage, as this segment understands their vulnerability and needs to be reminded of the severity of the situation, but also must be provided with information about the specifics of implementing mitigating measures, the associated cost, and the resulting benefits of risk reduction. Research on fire risk in the Southwest has shown that physically demonstrating what should be done, indicating that help is available, and providing that help 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. Conversely, for this action

segment of homeowners, stressing additional wildfire vulnerability may provoke feelings of exasperation and fatalism, resulting in the implementation of fewer risk reduction actions (the boomerang effect).

To invoke increased perceptions of response efficacy, it is especially important that managers be specific about how each mitigation activity will decrease risk and how its benefits will outweigh the costs (Kates 1971; Lindell and Prater 2002; Lindell and Whitney 2000; Tierney 1993). Recent research on earthquake risks has demonstrated the importance of response efficacy factors in influencing behavioral intentions to adopt mitigating measures. As part of the Protective Action Decision Model (PADM) (Lindell and Perry 2000), these hazard adjustments directly correlate to the response efficacy dimension. This model focuses on three aspects to response efficacy: communicating the effectiveness of actions in protecting *both* persons and property, and the suitability of risk reduction actions for additional purposes other than earthquake protection (Lindell and Prater 2002; Lindell and Whitney 2000). Additionally, quite a bit of the qualitative research (Integrated Resource Solutions 2004; McCaffrey 2004a, 2004b) has found that the homeowners often undertake fire risk reduction actions not only to reduce wildfire risk, but also to create better wildlife habitat, promote healthier trees that are more resistant to insect and plant infestation, and increase water supplies.

For action homeowners, feelings of self-efficacy are also important in motivating behavioral intentions to reduce the risks of wildfires. Self-efficacy measures such as cost, time and effort, knowledge and skill, tools and equipment, and required cooperation with others are also included in the PADM as resource-related attributes (Lindell and Perry 2000). As this research demonstrates, cost is listed as the biggest impediment to creating defensible space for the action homeowners. Providing funding incentives, grants, and state programs that give landowners financial assistance to clear their property have encouraged people to undertake fire risk mitigation activities that they might have viewed as too costly without outside assistance (Steelman and Kunkel 2004). Additional research should explore which self-efficacy factors are most important in motivating homeowners and how best to communicate about resources, tools, knowledge, and funding to reduce the risks of wildfire.

Providing homeowners with the tools, knowledge, and resources needed to thin their property and create defensible space is vital to motivating action homeowners. The town of Ruidoso, New Mexico, has been cited as an excellent example of a community that is proactively addressing its wildfire threat (Integrated Resource Solutions 2004; Steelman and Kunkel 2004). This community has prepared demonstration houses that show what fire risk mitigation, or defensible space, should look like. Additionally, they provide pickup and hauling of thinned or slash materials, free site assessments, a state-run cost-share program to pay up to 70 percent of the thinning costs, and thinning

services for elderly homeowners, among many other services (Integrated Resource Solutions 2004; Steelman and Kunkel 2004). These are examples of the ways in which managers can actually encourage desired actions by working with homeowners to accomplish those risk reduction behaviors.

In addition to the messages of vulnerability, risk severity, self-efficacy, and response efficacy, there are still potential managerial questions of how and when to communicate the various risk messages. Although correlations between social, cultural, and demographic measures and adoption of mitigating measures (for earthquakes) have been demonstrated to be small (Lindell and Perry 2000), a significant number of results from the sociocultural literature provide insight, direction, and ideas for the communication of risk to various diverse segments of the public. In addition, managers responsible for communicating the risks of environmental hazards must be able to present these messages to a variety of homeowner segments, including culturally, ethnically, and racially distinct groups. The literature on natural hazards provides information on risk communication messages for both majority and minority groups, much of which is applicable to wildfire. Selected examples of how and when to communicate follow.

It is empirically known that there is a difference in the way American majority and minority groups assess the credibility of hazard warning sources and respond to those warnings. Differences also exist within minority groups. For all groups, however, sources must be considered credible and trustworthy so that people trust the source of the information and the content of the message (Lindell and Perry 2004). Thus it is important that managers know their affected groups and who those groups consider to be credible sources—respected community leaders or opinion leaders, for example. Lindell and Perry (2004) found that authorities such as police and fire departments are considered credible sources by the majority of whites, African Americans, and Mexican Americans in their study, except in certain areas where the police have targeted minorities for crime enforcement.

It is also important that managers increase their own credibility by direct interaction and appropriate communication with their constituent groups (Lindell and Perry 2000, 2004; Lindell and Whitney 2000). Interactive communication allows for immediate feedback from the public, which can indicate to managers when a message is not being understood or does not meet the needs of the segment. Direct, face-to-face communication in the form of presentations and door-to-door assessments increases credibility and encourages adoption of mitigation recommendations. This type of communication also allows for an assessment of the homeowner's stage of readiness, so that the message can be appropriately targeted. Recent research on fire risk communication in the Southwest among whites, as well as other groups, found that direct, face-to-face communication in the form of presentations at local meetings, forest walks with locally knowledgeable people such as fire department personnel, and one-on-one site assessments were

considered to be effective forms of risk communication (Integrated Resource Solutions 2004).

Research in the hazard literature has also shown the importance of peers in transmitting and influencing the adoption of hazard adjustments or mitigation measures. Research by Lindell and Perry (2004) found that Mexican Americans were likely to consider peers (friends, relatives, and neighbors) as credible information sources concerning the risks of natural hazards. This group was more likely to consider peers as credible sources than were whites or African Americans. Land managers should communicate with local fire departments, neighborhood groups, and community leaders and organizers about the various risk messages that might be effective for homeowners in different segments of risk readiness.

Lindell and Prater (2000) discuss the role and importance of indirect hazard experiences, such as those experienced by friends and coworkers, in predicting adoption of hazard adjustments, without reference to distinct cultural groups. Additionally, McCaffrey (2002) has found that indirect wildfire experiences, such as stories or visits by neighbors and friends, have more of an impact on influencing greater adoption of mitigating behaviors by homeowners than does direct wildfire experience. Indirect experience with fire can be helpful in increasing awareness, which can increase feelings of vulnerability and comprehension of risk severity. These indirect experiences can include footage of fires and their results viewed in the media, testimonials of victims, and information from affected friends and relatives. Indirect experience can also create teachable moments for recent immigrants to the United States when learning of disasters that have occurred in their homeland or country of origin (Stallings 1986).

Various aspects of the mass media are considered major channels for communicating hazard and risk information to the public, which can be useful for managers in certain instances. Using sources in the appropriate language is critical when dealing with many ethnically diverse groups, especially newly arrived immigrants. Language-specific television and radio stations, as well as newspapers, are helpful in this regard (Lindell and Perry 2004). It has also been found that different ethnic groups seem to prefer different media sources or communication channels. Some research has shown that whites like print media best; Mexican Americans lean toward oral media, such as local radio and television stations and neighborhood meetings; and African Americans prefer local radio, newspapers, and brochures at neighborhood meetings (Lindell and Perry 2004; Nelson and Perry 1991; Perry and Nelson 1991). For these preferences to have wide application for managers, their rationale, extent of occurrence, and relationship to communications concerning wildfire risk require in-depth examination.

When to communicate risk information to the public can be as important as the content of the information and how it is communicated (Lindell and Perry 2004). A few suggestions from the literature on natural hazards are equally

appropriate for communicating wildfire risk. Fire events, as with other natural disasters, can create opportunities to raise awareness and stress vulnerability and risk severity. These events are teachable moments, brief windows of opportunity that put vulnerability to environmental hazards, such as wildfire, on the political agenda and on the minds of those affected by the event or in proximity to it. Research shows that the timing of the catastrophe and the dissemination of the information is critical because interest wanes as time passes (Lindell and Perry 2004; Sims and Baumann 1983; Weinstein 1989). After fire events, fire managers can target neighborhoods or individuals that will respond more effectively to risk severity and vulnerability messages with information about each specific homeowner's stage in addressing risk reduction, such as precontemplation or contemplation. In Ruidoso, during the high wildfire risk period of March through August, the community plays a 19-minute Jack Cohen defensible-space video daily at 6:30 p.m. on all the major television stations (Integrated Resource Solutions 2004).

Perhaps the best advice for all types of land managers is to define the different segments of stakeholders in a public land manager's district or region. By developing an in-depth description and understanding of these potentially diverse segments within the communities surrounding public lands, managers are better equipped to come up with a strategy to effectively communicate with these stakeholders. Many times this information is available through housing associations, so land managers need to determine the gatekeepers in these communities. Based on developing an understanding of a segment's decision stage, level of knowledge, and other relevant information, the manager can target risk communication information in the most effective way.

Conclusions

Our chapter has examined various aspects of the cognitive perceptual process that homeowners experience when deciding whether to protect themselves and their property from wildfire. This research is particularly critical as population migration increases into rural, forested areas of the West that provide wildland amenities as well as greater wildfire risk. In this chapter, we integrated protection motivation theory (PMT) and the transtheoretical model (TTM) to investigate when homeowners are more or less likely to reduce their risk of wildfire impacts. In addition, we presented a set of important unanswered questions for future research and examined the managerial implications of our study.

As discussed, PMT states that stakeholder decisions to protect themselves from harm are enhanced by four critical perceptions: the severity of the risks, personal vulnerability to the risks, self-efficacy or confidence in one's ability to perform risk-reducing actions, and the response efficacy (effectiveness) of the risk reduction behavior. Even given these factors, individual motivations

to mitigate risk vary. Thus we introduced a factor that may explain varying individual motivations: the degree of readiness that an individual has to accept and act on a risk. The integration of stage theories such as TTM, which propose decisionmaking stages into which people can be classified based on their level of risk-reducing behaviors, provides a means of assessing degree of readiness. The decisionmaking stages relevant to our work include precontemplation, contemplation, and action. This chapter demonstrated that the four cognitive perceptions of PMT affect transitions between the decisionmaking stages of the TTM.

Based on the integration of PMT and TTM, we developed three hypotheses to explore the ways in which cognitive perception influences the decisionmaking stage. We tested these hypotheses in three communities in the western United States that have experience with wildfire. Our research verified that higher perceptions of vulnerability will be more strongly associated with intentions to perform risk reduction behaviors among precontemplatives than risk severity, response efficacy, and self-efficacy. For precontemplatives to consider mitigating risk and moving to the next decision stage, they must first feel vulnerable to wildfire risk.

We investigated the question of whether higher perceptions of vulnerability and risk severity will be more strongly associated with intentions to perform risk reduction behaviors among the contemplative group than response efficacy and self-efficacy. The results support this premise. In addition to perceptions of vulnerability, contemplatives must feel increased levels of risk severity to move to the next decision stage. Finally, we tested the hypothesis that higher perceptions of response efficacy and self-efficacy will be more strongly associated with intentions to perform risk reduction actions among homeowners in the action decision stage than vulnerability and risk severity. We confirmed that self-efficacy and response efficacy influence behavioral intention among the action group. An additional finding is that perceived risk severity is also significant in the action decision stage.

Overall, our results demonstrate that the groups of homeowners can be differentiated based on what is critical to move them from one decision stage to the next. We also gathered additional information on what people perceive to be the biggest impediments to taking mitigative actions. Cost and time were cited as the primary constraints among all groups, particularly by those in the contemplative group. Understanding these relationships can allow managers to target the type of information and assistance necessary to move their stakeholders toward taking action to mitigate the risks of damage from wildfire.

Stemming from this research, we also identified topics of significance for future examination and a set of implications for managers. As examples, it is important to understand the ways in which various communication techniques, such as informational literature, educational forums, websites, and demonstration sites, can help move homeowners through the various decision stages toward a goal of undertaking a set of mitigative actions. Effective

communication with different segments of homeowners (precontemplatives, contemplatives, action) can improve the probability that each group will engage in risk-mitigating actions. Our research explored three of the six TTM stages. Two others, preparation and maintenance, would be a valuable continuation of the present research, especially considering the importance of maintaining defensible-space actions over time—the maintenance decision stage.

Understanding homeowners' knowledge based on direct and indirect experience concerning wildfire and its role and impact on the PMT model is also desirable. Personal experience can have a powerful impact on risk recognition and the willingness to take protective measures. Comprehending the role of homeowners' personal experiences provides input into effective risk communication. Finally, we reiterate the importance of understanding the readiness stage, levels of knowledge, and appropriate communication techniques when it comes to encouraging homeowners to take appropriate actions to mitigate the risk of wildfire.

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