Environmental Advances 12 (2023) 100382

Contents lists available at ScienceDirect

Environmental Advances

journal homepage: www.sciencedirect.com/journal/environmental-advances

Perceptions of wildfire management practices in a California wildland-urban interface

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ARTICLE INFO

Keywords:
Collaboration
Defensible space
Prescribed fire
Theory of planned behavior
Wildfire

ABSTRACT

Wildland-urban interface (WUI) regions are exposed to increasing wildfire risk due to the effects of accelerating climate change on fuel flammability, as well as a legacy of fire exclusion that promoted fuel accumulations in seasonally dry forests of western US. State and Federal land management agencies are evolving policies and directing new resources to reduce the effects on homes and infrastructure in the WUI through fuel reductions and enhanced fire management measures. A widely supported strategy is to involve homeowners and their communities in efforts to reduce their exposure to wildfire risk by changing the structure and amount of unwanted vegetation around vulnerable structures, among other practices. Although these practices can reduce vulnerability to wildfires, people are hesitant to implement them for a variety of reasons broadly related to the issues of capacity and access to information. Based on Theory of Planned Behavior (TPB) conceptual framework, this study identifies salient factors impeding individual actions to reduce wildfire risks, and how those factors influenced willingness to participate in wildfire mitigation behaviors. This study examined intention to use prescribed fire and defensible space among community members as a wildfire management tool. Results from this study suggest intentions to undertake these wildfire management practices are positively associated socio-economic characteristics, along with knowledge regarding best practices, some perceived reasons, or hindrances to implementation, and ability to collaborate with others. These research findings have implications for designing and implementing policy instruments and improving community members' decision-making regarding practices to mitigate fire risk.

1. Introduction

Wildfire is undoubtedly one of the most significant and widespread natural disturbance agents in the Western United States, especially in California. Anthropogenic climate change has contributed to higher temperatures, drier conditions, and earlier snowmelt in California, which in turn has increased the risk of wildfire. Along with climate change and severe drought, the frequency and extent of wildfires and the area burning at high severity are surging (Abatzoglou and Williams, 2016; Westerling et al., 2006; Sam et al., 2022; Xu et al., 2022). Increasing fuel loads resulting from fire exclusion and other management activities, and expansion of human settlements into fire-prone vegetation driven by population growth and sprawling development patterns, have both contributed to more frequent and costlier large wildfires in recent years (Radeloff et al., 2005; Sam et al., 2021; Theobald and Romne, 2007). The occurrence of large, devastating wildfires emphasizes the need to comprehend all of their components, particularly in the wildland-urban interface (WUI), where houses are next to or mixed in with wildland vegetation (Radeloff et al., 2005). With more people relocating to the WUI each year, there is a growing concentration of people and property next to or inside regions of high wildfire danger (Radeloff et al., 2018; Mockrin et al., 2022). As the WUI continues to grow, there is a need to develop an understanding of how residents of the WUI can reduce their vulnerability to wildfires. Engaging local communities in mitigation measures is one of the best ways to control disastrous fires (Fischer, 2011; Kreuter et al., 2008; Roberts et al., 2019). Local residents, who generally have the most to lose in the case of a large fire, can positively impact mitigation activities in their communities.

By employing efficient mitigation practices, wildfires can be reduced

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https://doi.org/10.1016/j.envadv.2023.100382
Received 14 March 2023; Received in revised form 15 May 2023; Accepted 19 May 2023
Available online 20 May 2023

in intensity and severity. Examples of mitigation measures include implementing prescribed fire and mechanical fuel reduction (thinning), and creating and maintaining defensible space, in ways that directly engage communities (Blanchard and Ryan, 2007; Winter et al., 2009). These actions alter the kind and amount of undesirable vegetation and are regarded as the most effective measures to reduce wildfire severity and its risk to property (Stephens et al., 2012; Syphard et al., 2014; Shi et al., 2022). Numerous studies indicate communities in fire-prone WUI areas comprehend the risk of wildfires in their area and, as a response, implement at least some risk-mitigation efforts (Brenkert-Smith et al., 2006; Dickinson et al., 2015; Kyle et al., 2010; Larsen et al., 2021; Nelson et al., 2004). Although these techniques are becoming more widely accepted, there are still a number of obstacles to overcome before they can be implemented broadly enough to address the scale of current and projected vulnerability to wildfire risks (Fischer, 2011; Kobziar et al., 2015; McCaffrey et al., 2013).

Despite the recognized benefits of prescribed fire for wildfire management, there is hesitancy among landowners and stakeholders in California to adopt it. The complex regulatory framework requires permits from the California Department of Forestry and Fire Protection (CAL FIRE), approval from local air quality boards, and confirmation of safe weather conditions. Limited access to permits and recognition of local expertise contribute to confusion and barriers. Concerns about fire escape, smoke impacts, and liability further contribute to hesitancy. Additionally, the lack of resources and expertise, including equipment and training, hinders widespread adoption of prescribed fire. Defensible space regulations in many jurisdictions provide specific guidelines for vegetation management and fire-resistant construction. They require homeowners to maintain appropriate distances between trees and structures and clear dead vegetation. Adequate access, visible addresses, and water availability are also mandated. These rules create hesitancy due to the time, effort, and cost involved, as well as the perceived interference with property rights.

While published studies have demonstrated the effectiveness of fire control strategies to mitigate wildfire damage (McCaffrey and Olsen, 2012; Toman et al., 2011), there have been limited studies on public attitudes and actions toward such management practices to safeguard ecosystem and populations. A growing body of social science research has explored the wildfire mitigation actions of vulnerable community members (Brenkert et al., 2012; Stidham et al., 2014; Alcasena et al., 2019). Decisions on reducing the risk of wildfires are often influenced by a variety of factors in addition to risk assessments. According to past research, a number of crucial factors, including shared goals and a similar vision, relationships and trust, a place attachment, information sharing, and community outreach and education, may influence whether residents take part in these risk reduction activities (Winter and Fried, 2000; Vaske and Kobrin, 2001; McGee, 2007; Alam, 2011; McCaffrey and Olsen, 2012; McCaffrey et al., 2013; Paveglio et al., 2015; Stasiewicz and Paveglio, 2022). As a result, understanding public attitudes, perceptions, and opinions about different approaches is critical to developing successful fire management measures (Bright and Burtz, 2006; Gunderson and Watson, 2007). This research employs a conceptual framework to identify key factors that influence willingness to participate in wildfire mitigation behavior. To our knowledge, there have been limited research to predict future behavioral trends in wildfire mitigation. This gap is noteworthy given the large number of resources dedicated to mitigating effects of wildfires over the last several decades. Considering the fact that communities and individuals base significant decisions on their perceptions and placements within a local landscape, such an examination is essential. Theoretical studies have provided a variety of viewpoints, but the discipline has yet to agree on a single theory or collection of ideas to explain the phenomena. The Theory of Planned Behavior (TPB) (Ajzen, 1991) provides a useful context to examine individual-level components to understand the dynamics of mitigation activities, with a growing focus on measuring beliefs, attitudes, and intentions.

1.1. Theoretical framework

This study utilized TPB for predicting public attitudes toward fire management decisions. TPB asserts that behavior is influenced by the intention to perform specific behaviors. These intentions in turn are influenced by attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991; Wang and Ritchie, 2010). The main idea is, whether one actually implements management activities around their residence in WUI depends on their intention to do so. While the literature is relatively limited, the TPB is being used to measure and identify some factors associated with wildfire mitigation behavior. Homeowners' attitudes, subjective standards, and perceived behavioral control were used by Bates et al. (2009) to explain why people intended to protect their houses and the environment from wildfires. The same framework has been applied in the wildfire mitigation field to understanding landowners' acceptance and intentions to approve fuel management practices, government policies focused on mitigation behaviors (Winter et al., 2002; Winter et al., 2009), and how knowledge predicts homeowners' attitudes, subjective norms, and perceived behavioral control in the context of protecting the environment and home against wildfires (Bates et al., 2009). Previous studies have found that individual socio-demographic variables such as age, gender, education, income, past experience with wildfires significantly influence perceptions and behavioral intentions regarding wildfire management practices (Joshi and Arano, 2009; Thapa, 2022a). However, to the best of our knowledge, TPB has not been applied extensively to predict behavior in use of wildfire management practices. In trying to map behavioral intentions, the TPB can be used as a basis for predicting public attitudes towards wildfire management decisions.

The first part of the TPB model (Fig. 1) emphasizes the significance of individual, sociodemographic, and informational background factors in shaping an individual's beliefs (behavioral, normative, and control), which in turn influence three predictors of behavioral intention (attitude toward the behavior, subjective norm, and perceived behavioral control) (Fishbein and Ajzen, 2010). Individuals' opinions about the potential benefits or drawbacks of engaging in the behavior are known as behavioral beliefs. An individuals' attitude toward engaging in an action is determined by their behavioral beliefs. In context of wildfire practices, attitudes can include beliefs about the importance of taking steps to prevent or manage wildfires, as well as perceived benefits and costs of doing so. For example, if an individual has positive attitude toward wildfire prevention, they may be more likely to take action to reduce the risk of wildfires.

Individuals who hold normative beliefs consider that the opinions of important figures in their lives would determine whether they participate in a certain behavior or not. The subjective norm, or social pressure, to engage in or refrain from engaging in an action, is determined by normative beliefs (Fishbein and Ajzen, 2010). This may include the beliefs and expectations of family members or community about the importance of taking action to prevent or manage wildfires. For example, if an individual's social network believes that wildfire prevention is important, they may feel more pressure to engage in those practices themselves.

Control beliefs are beliefs about individual's attempts to engage in the behavior. Perceived behavioral control is based on control beliefs, which take into account any barriers that may need to be overcome as well as the availability of knowledge, skills, opportunities, and other resources needed to carry out the behavior (Fishbein and Ajzen, 2010). For example, if an individual feels that they have the knowledge and resources necessary to implement management practices, they may be more likely to engage on those behaviors.

Together, attitudes, subjective norms, and perceived behavioral control can help explain and predict an individual's behavior related to wildfire management practices. Interventions and strategies aimed at promoting these practices may target one or more of these factors, such as by providing education and resources to increase perceived

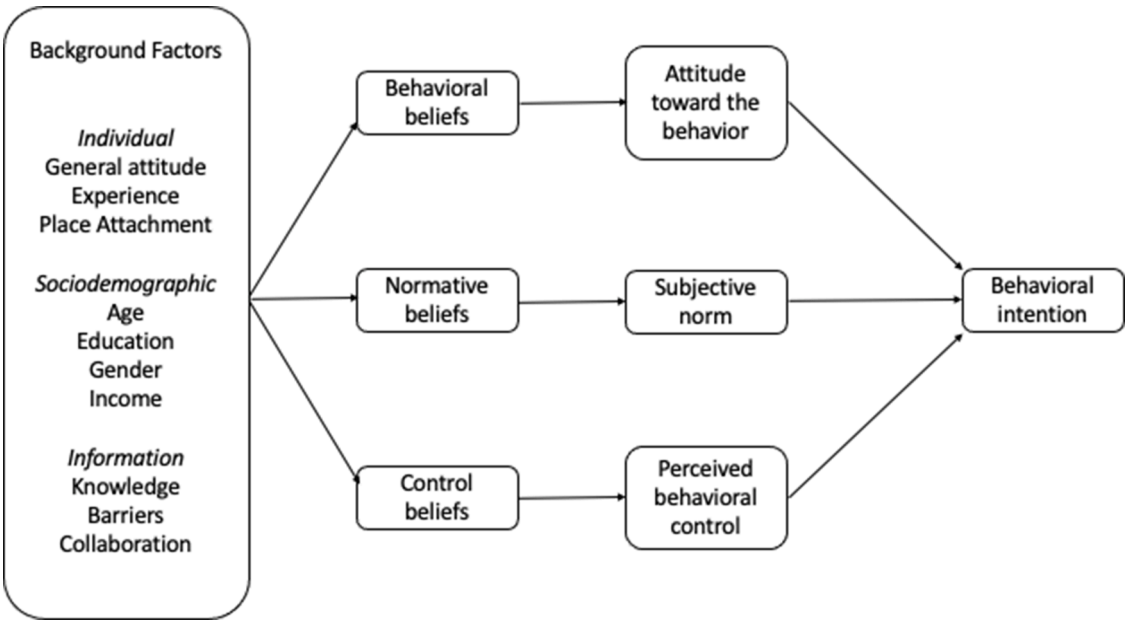

Fig. 1. Conceptual framework regarding implementation of fire management practices (modified version from Fishbein and Ajzen 2010).

behavioral control, or by using social norms to promote positive attitudes and subjective norms related to wildfire prevention and management. The framework used here can assist community residents, other stakeholders, including wildfire and natural resource professionals in understanding collective action to address wildfire risks.

In this study we propose the following objectives: to assess community members' (1) perceptions of wildfire risk; (2) knowledge and support for the use of wildfire management practices; and (3) opinions about their role in wildfire management planning in the wildland-urban interface. To assess model stability, we hypothesize that:

1. H_1: There is a significant interest in usage of wildfire management practices

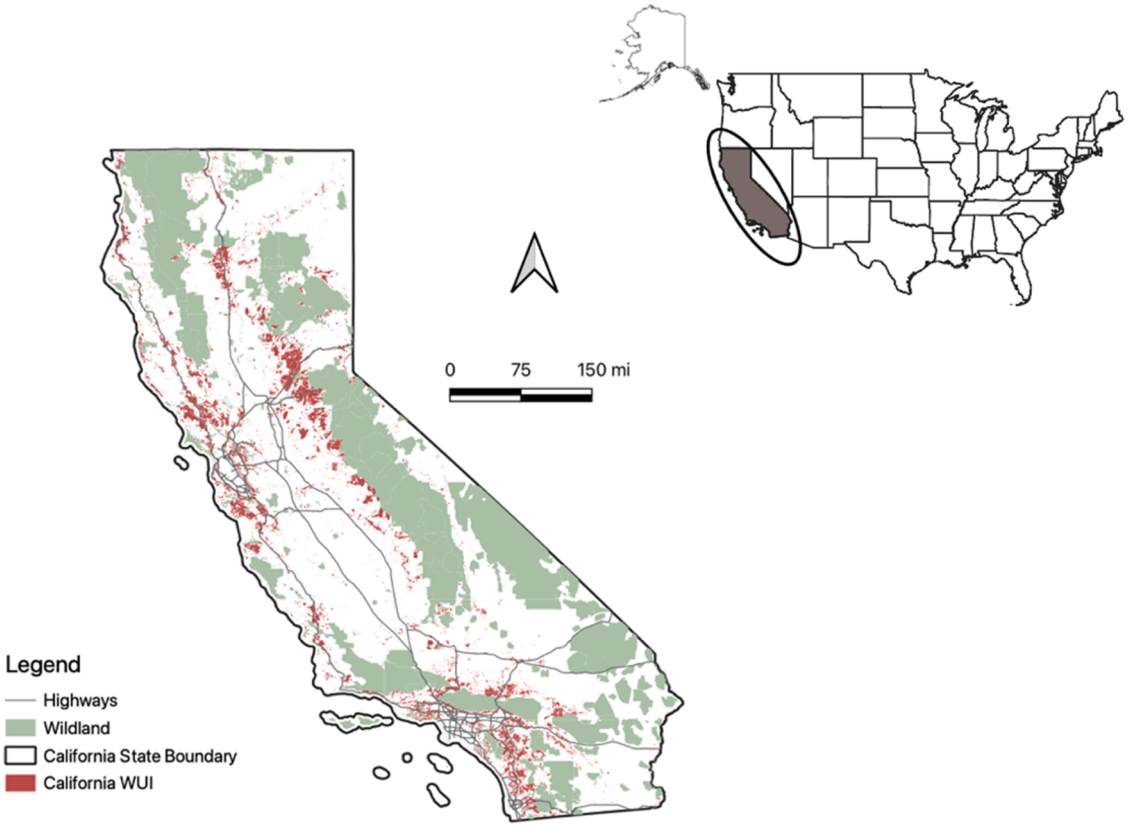

Fig. 2. California wildland urban interface (generated with data available from http://silvis.forest.wisc.edu/data/wui-change/).

2. H_2: Intent to apply wildfire management practices depends on sociodemographic characteristics, place attachment, potential for collaboration, reasons for not implementing (barriers), and relevant knowledge.

2. Methods

2.1. Participants and procedures

This study integrated multi-method forms of primary data collection. Data collection initially started with key informant interviews (KIs) in Mariposa County, California (Appendix 1). The goal of KIs was to gather data from a diverse group (District Supervisors, Fire Safe Council, CalFire) who represented various interest groups. Ten on-site KIs were conducted in the study area. Data was collected until saturation was achieved (i.e., when subsequent interviews supplied recurring information without contributing new knowledge to existing information). This led the foundation to the development of a multi-page standard survey questionnaire (Appendix 2) which was reviewed and approved by the University of California Institutional Review Board (IRB). Web-based survey was employed to gather information about wildfire knowledge, different management practices, along with attitudes, normative influences, and perceived behavioral controls regarding wildfire mitigation efforts. The responses qualified for this analysis were collected from residents who identified themselves as homeowners/landowners in the WUI from different parts of California (Fig. 2). While debates on the definition and implications of the term WUI exist (Stewart et al., 2007; Caggiano et al., 2020; Carslon et al., 2021), we define WUI as an area where human settlements and natural vegetation meet each other, and because of this the risk to community life and property from fire and associated hazards is collective, without making a distinction between the intermix and interface zones. The state's expansive area includes wide range of geographical and climatic attributes. With valleys, cliffs, and steep ridges, the area has terrain that can increase the intensity of wildfires. Wildfire is a concern throughout the state, often incurring millions of dollars in containment and suppression costs annually. The survey was open statewide because of these inherent risks and the associated opportunities for studying wildfire mitigation behaviors. This provides the ability to examine behaviors across differing community dynamics.

Sampling assured that gender, age, education, and income characteristics were included and represented. To check for potential bias, respondents were asked compared with general population. For the most part, the demographic profile of respondents was similar to that of California's population (CPS, 2020) (Table 1). These data show that, overall, survey respondents were older than the general population. This study purposefully sampled respondents over 18 years of age or over. Median annual income of survey respondents was approximately similar to that of general population. Survey respondents tended to have less education than general population. In terms of gender, proportion of survey respondents were slightly higher to that of the general population.

The survey originally recorded 247 responses, of which only 183 were qualified, excluding partial responses. General survey questions include: (1) attitudes of residents toward wildfire; (2) behaviors and attitudes toward wildfire risk management practices; (3) residents meanings associated with local landscapes; (4) various constraints to the use of different practices; and (5) interest in participating in collaborative fire management arrangements.

Table 1
Mean values for population and sample.

Variable	Population	Sample
Age (years)	37	46
Gender		
Male	50%	55.7%
Female	50%	44.3%
Annual household income	$78,672	$82,500

2.2. Relevant variables

The conceptual model was operationalized to measure knowledge, attitudes, place attachment, and barriers to the use of management practices, as well as to account for socioeconomic characteristics. Measured socioeconomic characteristics consisted of age, gender, education, and annual household income. 'Age' was the age of the respondents as a continuous variable in years. 'Gender' referred to the respondent's gender (0, female; 1, male). 'Education' referred to respondents' level of education, originally with five categories, however, 'Education' was recoded as a dummy variable (0, all others; 1, more than high school graduate) to check whether advance education impacted the dependent variable. 'All others' included 'Less than high school', 'high school (or equivalent) graduate', or 'other'. 'Income' originally had six different categories ranging from less than $25,000 to more than $150,000. Responses were recoded to a dummy variable (0, less than $75,000; 1, more than $75,000). Respondents were asked if they were familiar with the concepts of prescribed fire (PF Knowledge) and defensible space (DS Knowledge). These responses were coded to a binary format: 0, no (never heard of it); and 1, yes. Following measurement of PF and DS knowledge, respondents were asked to what extent they were interested in implementation of prescribed fire and defensible space (PF and DS Interest), the dependent variable in the analysis. A four-point scale (not at all, not much, some, a lot) was recoded to a dummy variable: 0 (not at all, not much) and 1 (some, a lot). Respondents were asked about their level of attachment to the place where they live. The scale included six emotional attachment measures and four functional measures (Williams and Vaske, 2003). Responses were recorded in five-point Likert scales (1, strongly disagree; 2, disagree; 3, agree; 4, somewhat agree; and 5, strongly agree). A summative scale (Place Attachment) was created from items by averaging the 10 measures to measure agreement (Williams and Vaske, 2003). Similarly, respondents were asked for their reasons for not implementing prescribed fire or defensible space. The scale included six measures (liability issues, costs, parcel size, coordination, technical knowledge). Responses were recorded in five-point Likert scales (1, strongly disagree; 2, disagree; 3, agree; 4, somewhat agree; and 5, strongly agree). A summative scale (Barriers) was created from these items by averaging 5 measures (as described above) to measure agreement with reasons for not implementing wildfire management practices. Also, respondents were asked if they were interested in coordinating (Collaboration) with individuals, private organizations, and government entities to implement management practices. Responses were based on 5 five-point Likert scale (1, strongly unlikely; 2, unlikely; 3, likely; 4, somewhat likely; and 5, strongly likely). Responses were recoded to 0 (strongly unlikely, unlikely) and 1 (likely, somewhat likely, strongly likely).

2.3. Analysis

A Chi-square test was used to test the first hypothesis i.e., to determine if there were significant associations between pairs of categorical variables. Chi-square tests provided a picture of the association between two variables. If the proportion of individuals in the different columns varied significantly, the two variables were dependent (i.e., there is contingency). If there was no contingency, the two variables were considered independent. To explore the other hypothesis, a binomial logistic regression model based on our conceptual framework was used. Based on one or more continuous or categorical independent variables, this model was used to estimate the likelihood that an observation would fall into one of the two categories of a dichotomous dependent variable. A positive coefficient for an independent variable meant the independent variable had a positive impact on the likelihood that the dependent

variable would occur, whereas a negative coefficient meant the independent variable had a negative impact. Reflecting the components of the conceptual model, the set of indicators were entered in successive stages to observe changes in the model.

There are some limitations of this research. Findings are based on small sample along the California wildland urban interface. A higher response rate could boost our confidence in extrapolating beyond the study population. Despite this limitation, the results of this survey should provide useful insights for land use managers and planners in WUI areas. Future studies might employ a different method to scale up to a larger population over the range of the fire prone WUI in California. Studies such as these aid in the development and implementation of successful regional policies to increase community engagement in wildfire risk mitigation.

3. Results

3.1. Interest in fire management practices

More than half of the respondents were familiar with the term defensible space (68%) and prescribed fire (60%). Of the respondents supportive of one or more of these practices, 77% of the respondents had an interest in defensible space practices. A Chi-squared test revealed association between 'Gender' and 'DS Knowledge' variables with an interest in defensible space. Male were 19% more interested in defensible space practice than female respondents ($p = 0.001$). Respondents with higher defensible space knowledge were 22% more interested in defensible space practice than respondents with a lower level of knowledge ($p = 0.003$). Similarly, 72% of the respondents had an interest in prescribed fire. A Chi-square result revealed association between 'Gender' and 'PF Knowledge' variables with an interest in prescribed fire. Male respondents were 16% more interested in prescribed fire than female respondents ($p = 0.018$). Respondents with greater knowledge regarding prescribed fire were 21% more interested in prescribed fire practice than respondents with a lower level of knowledge ($p = 0.001$). Results are in line with what we had initially anticipated in terms of the increased interest in using various fire management techniques (hypothesis 1). Despite an increase in interest in wildfire management practices, results also highlight different reasons for not implementing different practices. Sixty-nine percent of participants collectively reported liability to be the primary reason. Concern about costs was recognized as another reason by 62% of respondents. Fifty-six percent reported technical capacity/knowledge as other reason followed by coordination (51%).

3.2. Intent to apply fire management practices

3.2.1. Intent to practice prescribed fire

A logistic regression model was employed where variables were entered in successive stages as predictors of support for use of prescribed fire. Model I with only 'Socio-economic' characteristics explained only 13% of the variance in support of prescribed fire. Three of the four predictive variables in model I were significant: Age, Gender, and Income. Model II introduced PF Knowledge which together with socio-economic characteristics explained 29% of the variance in support for prescribed fire. Place Attachment was introduced in model III which resulted in model explaining more of the variance in the dependent variable ($R^2 = 0.32$). Model IV included the 'Barriers' variable, which increased the explained variance to 37%. The final model (Table 2) introduced 'Collaboration' which increased the variance explained in the dependent variable higher to 43% for the full model. All models were statistically significant. Four of the eight predictive variables in our final models were significant: Age, PF Knowledge, Barriers, and Collaboration. Young age respondents are 31% more interested in implementing prescribed fire than their counterparts ($p = 0.025$). Similarly, respondents with higher knowledge regarding prescribed fire are almost three times more interested in applying prescribed fire than those without knowledge ($p = 0.018$). In addition, as the 'Barriers' score increased, respondents are 34% less likely to prefer prescribed fire ($p = 0.028$). Finally, respondents who are interested in collaboration with others are 70% more interested in applying prescribed fire in comparison to the respondents who were not interested in collaboration ($p = 0.001$). Variables such as Education, Gender, Income, and Place Attachment were not found statistically significant in the analysis.

Table 2
Exp(B) value and Odds Ratio derived from logistic regression for Prescribed Fire final model.

Variable	Intent to apply Prescribed Fire		
	B	Odds Ratio	P-value
Socio-economic			
Age	-0.013	1.312	0.025*
Education	0.239	1.737	0.602
Gender	-0.093	0.497	0.801
Income	0.294	1.218	0.440
PF Knowledge	0.667	2.765	0.018*
Place Attachment	0.143	1.152	0.532
Barriers	0.443	0.661	0.028*
Collaboration	0.529	1.708	0.001*
Nagelkerke R^2	0.43		

* Significant at $p < 0.05$

3.2.2. Intent to practice defensible space

Predictive variables were entered in successive stages to predict intention to practice defensible space. Model I with only 'Socio-economic' characteristics explained only 17% of the variance in interest in defensible space implementation. Model II introduced 'DS Knowledge' as a predictor variable which increase variance explained to 36%. 'Place Attachment' was added in Model III which explained 40% of the variance in the dependent variable. Adding 'Barriers' resulted in Model IV explaining slightly more of the variance ($R^2 = 0.43$) in support of defensible space. The final Model (Table 3) added 'Collaboration' which increased the variance explained in the dependent variable slightly to 49%. All models were statistically significant with models improving most after inclusion of DS Knowledge (Model II). The final model (Table 3) had five significant predictive variables: Age, Income, DS Knowledge, Barriers, and Collaboration. Younger respondents are 46.7% more interested in practicing defensible space than their counterparts ($p = 0.005$). Household with higher income are 44.2% more interested in applying defensible space ($p = 0.021$). Respondents with more knowledge of defensible space are more than three times more interested in using it as a management practice than those with little or no knowledge ($p = 0.003$). As the 'Barriers' score increases, respondents are 24% less likely to favor defensible space ($p = 0.028$). Finally, individuals who are interested in collaborating with others are more than two times as interested in using defensible space than those who are not

Table 3
Exp(B) value and Odds Ratio derived from logistic regression for Defensible Space final model.

Variable	Intent to apply Defensible Space		
	B	Odds Ratio	P-value
Socio-economic			
Age	-0.117	1.467	0.005*
Education	0.332	1.411	0.186
Gender	0.293	1.329	0.218
Income	0.417	1.442	0.021*
DS Knowledge	0.722	3.469	0.003*
Place Attachment	-0.235	1.126	0.232
Barriers	0.344	0.766	0.011*
Collaboration	0.566	2.114	0.001*
Nagelkerke R^2	0.49		

* Significant at $p < 0.05$

($p = 0.001$). Variables such as Education, Gender, and Place Attachment were found to have no significant correlation in the analysis.

Results from this study suggest intent towards PF and DS would be positively influenced by age and income, along with knowledge regarding both practices, some perceived reasons for not implementing those practices, and collaboration with others (hypothesis 2). These findings were fairly consistent with our initial expectations. Results support the hypothesis of a causal chain between variables of our conceptual model.

4. Discussion

The TPB provides a useful framework for understanding the role of collective actions in shaping intentions to apply adaptive management practices in the context of wildfires. Collective actions can build on an adaptive approach to wildfire management practices by influencing attitudes, subjective norms, and perceived behavioral control, which in turn can increase intentions to apply adaptive management practices. By working together, communities can create a supportive environment that encourages the adoption of these practices, ultimately leading to more effective and sustainable wildfire management. While the models guided prediction of intentions to implement fire management practices, the inclusion of additional factors enriches the conceptual framework of beliefs, attitudes and intentions. The results suggest that respondents were interested in using prescribed fire and defensible space as a management tool as explained by age, annual income, knowledge of prescribed fire and defensible space, barriers, and collaboration. This increased interest might be attributed to the idea that some of the distinctive qualities of defensible space and prescribed fire make them preferable to other methods. In terms of demographic characteristics, age was negatively significant in both regression models. Younger respondents were more interested and were more likely to implement prescribed fire or defensible space practices. This finding is similar to other studies that have found a negative association between age and acceptance of forest management practices (Joshi and Arano, 2009). Surprisingly, education and gender were not significant predictors of mitigation practices despite their importance in wildfire management in previous research.

Results from this study are in line with studies that have shown that understanding the role of prescribed fire and defensible space is crucial for reducing the effects of wildfires (Kreuter et al., 2008; Morton et al., 2010; Piatek et al., 2010; Ryan 2012; Thapa, 2019) and can be an important determinant for risk perception and mitigation. This study suggests that educational efforts to increase knowledge can significantly raise interest and support for management programs. An increased level of knowledge contributes to understanding of risk and benefits of the practice required in management efforts. Prior research claimed knowledge gained from experts was favorably related to both structural and vegetation mitigation behaviors (Sharp et al., 2013; Dickinson et al., 2015). Other studies have supported this claim with associations between fire-related information and mitigation behavior (Brenkert-Smith et al., 2012; Champ et al., 2013; Hall and Slothower, 2009).

In general, the attachments that individuals have to a place is important for public acceptance of management practices. Previous studies have illustrated how the relationships people have with a particular place influence environmental attitudes and interest in using management practices (Alam, 2011; Gobster et al., 2022; Stedman, 2003; Williams and Vaske, 2003). Contrary to other results, however, this study did not find place attachment to be a statistically significant indicator of intention and support for wildfire management practices. For one possible explanation, Paton et al. (2006) discovered that persons with high environmental values and a sense of attachment to the environment did not favor mitigation strategies like prescribed fire that affected the ecosystem, regardless of how they felt about safety. This may be the situation because individuals are concerned about changing the landscape and altering the environment when mitigation requires modifying the area's surroundings (Absher et al., 2009; Brenkert-Smith et al., 2006). Another explanation could be individuals might have experienced large and damaging wildfires, and because of place attachment's temporal quality, it is possible to feel less attached to place or environment and not develop an emotional connection. However, further study is required to determine how to make use of WUI inhabitants' place attachment to promote better mitigation and planning.

Implementation of prescribed fire and defensible space is challenging. This research identified multiple factors such as 'liability', 'technical capacity', 'costs', and 'coordination' as the major reasons for not implementing management practices. Literature has documented liability as a major reason for not using either prescribed fire or defensible space (Bailey et al., 2019; Kobziar et al., 2015; Kreuter et al., 2008; Morton et al., 2010). This earlier research revealed significant worries among landowners and organizations over litigation resulting from an escaped fire or smoke issue. Also, another reason may be inability to dispose of excess vegetation material which may produce highly flammable litter generated from creating and maintaining defensible spaces. Results also highlight technical capacity as an important reason, which is similar to lack of technical knowledge and 'need for assistance' as reported by Jarrett et al. (2009) and Kreuter et al. (2008). According to the findings, demand for defensible space and prescribed fire is rising but technological capability is not. This is due to a lack of technical service providers and burn specialists available in the area. Cost is often considered to be a critical reason for not implementing practices. This finding was consistent with results from Fischer (2011), Kobziar et al. (2015) and Thapa (2022b), which found management costs at a regular interval were higher than that what homeowners preferred. Lack of financing from nonprofit organizations and government agencies for projects like prescribed fire or defensible space might be one contributing factor for this. Another factor that might be influenced by variations in risk perceptions is the cost-benefit analysis done by homeowners. Homeowners balance the expected benefits of their greater protection against the anticipated costs of mitigating (in terms of time and money), and they only decide to do so if the expected benefits outweigh the anticipated costs.

Intent towards applying different fire management practices was also influenced by interest in collaboration with various entities, a result which is consistent with previous studies (Kobziar et al., 2015; Kreuter et al., 2008; McCaffrey and Olsen, 2012; Gan et al., 2015; Thapa et al., 2018). This study suggest collaboration with peers may influence perceptions regarding prescribed fire and defensible space use. Collaboration can vary from information sharing, coordinating services, and sharing of services between homeowners and landowners as well as agencies and organizations. Numerous potential advantages of collaborative planning have been reported in prior research, including decreased conflict, the discovery of innovative solutions, increased agreement among varied interests, and increased capability to achieve goals (Bihari and Ryan, 2012; Brummel et al., 2010; Reams et al., 2005). One reason could be that collaboration works toward educating the public, local communities, and decision-makers about the benefits of practices, and enhances communication between officials, fire-managers, and homeowners (Ryan and Hamin, 2008). Additionally, if participants are dedicated to continuing their engagement throughout the completion of the plan, project, or activity, collaboration produces long-term advantages. Social support from peers to engage in fire risk mitigation activities may contribute to the willingness to see projects through to completion.

5. Conclusions

This study verified the applicability of using the conceptual model to assess respondent intentions and behaviors towards wildfire mitigation using prescribed fire and defensible space. The results are in line with our initial predictions regarding the increased interest in wildfire management practices. According to the results, some demographic

characteristics, knowledge regarding management practices, some perceived reasons for not implementing prescribed fire or defensible space, and collaboration with other homeowners, local organizations, or non-profit organizations, all influence intentions to use prescribed fire and defensible space practices. The findings from this study add to our deeper understanding of the factors that influence decision-making and suggest a need for future research to further understand other factors. The findings of this study have implications for designing and implementing policy instruments as well as enhancing community members' decision-making regarding practices to reduce fire risk. This research suggests implementing a range of measures, such as establishing a framework or a law for wildfire response and recovery that includes provisions for mutual aid agreements between local governments and increased funding for firefighting resources, aimed at improving wildfire prevention and response. This research also suggests, future research should consider additional factors such as prior experience, professional trust, incentive programs, environmental concerns, and the accuracy of individuals' assessment of their exposure to and vulnerability to wildfire risk, all of which could influence individuals' intention to apply risk mitigation practices. The findings suggest that additional efforts should be made to increase public awareness and knowledge of prescribed fire and defensible space in order to expand the use of these strategies for wildland fire management. These findings should be tested and expanded upon in future studies, with a focus on how the public perceives fire management practices.

CRediT authorship contribution statement

Samrajya Bikram Thapa: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Jeffrey S. Jenkins:** Conceptualization, Methodology, Validation, Resources, Writing – original draft, Writing – review & editing, Supervision. **Anthony Leroy Westerling:** Conceptualization, Methodology, Validation, Resources, Writing – original draft, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Acknowledgment

This work was funded by the National Oceanic and Atmospheric Administration Climate Program – NOAA NA170AR4310284.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.envadv.2023.100382.

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