Predicting Homeowner Wildfire Mitigation Behaviors

in the Wildland-Urban Interface

by

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ABSTRACT

Increasingly, wildfires are threatening communities, forcing evacuations, damaging property, and causing loss of life. This is in part due to a century of wildfire policy and an influx of people moving to the wildland urban interface (WUI). National programs have identified and promoted effective wildfire mitigation actions to reduce wildfire risk; yet, many homeowners do not perform these actions. Based on previous literature and using the theory of planned behavior (TPB), this study proposes an integrated wildfire mitigation behavioral model to assess and identify the factors that influence homeowners' wildfire mitigation behaviors. Specifically, the study tests the validity of the theory of planned behavior as a foundational model in exploring wildfire mitigation behaviors, develops and empirically tests a wildfire mitigation behavioral model, and explores the role of homeowner associations (HOA) on wildfire mitigation behaviors. Structural equation modeling was used on data collected from homeowners with property in the WUI in Prescott, Arizona. Results suggest TPB provides an acceptable model in describing homeowner wildfire mitigation behavior. For HOA residents, attitudes toward wildfire mitigation behaviors play an important role in predicting intentions to perform these behaviors. Additionally, perceived constraints directly influenced actual mitigation actions. For non-HOA residents, subjective norms influenced intentions to mitigate. Implications for research and local wildfire mitigation programs and policy are discussed.

DEDICATION

I dedicate this dissertation in memory of Donna Dickinson. She was one of the strongest women I have known and had a loving kindness that was boundless. Not only did Donna and her husband Allan open their home to me during the completion of this dissertation, Donna single handedly took it upon herself to help prepare mailing materials when I was busy with other tasks. Her persistence allowed me to stay on schedule and meet deadlines. Her passing took us all by surprise and has left emptiness in our hearts.

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The Prescott Area Wildland Urban Interface Commission was instantly excited for the possibilities of the research and was instrumental in creating connections with the City of Prescott and surrounding Yavapai County neighborhoods. The Commission also provided a platform for sharing my ideas and results with neighborhoods, government officials, and land management agencies. The commission's partnership in this research endeavor was invaluable.

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Because of the size of the project, I sought help with managing the data collection and input. Virginia Miller enthusiastically stepped up and offered to help. She was the sole reason I was able to meet the tight deadlines I faced in finishing this dissertation.

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INTRODUCTION

With an average of over 1,300 residential homes destroyed every year from wildfire and many more damaged or threatened, wildfire's impact on people and property has become an increasingly frequent national news story in the United States (National Interagency Fire Center, 2015). Major wildfires regularly threaten communities, force evacuations, damage property, and are the cause for loss of life. This is in part because of two dynamics, a century of forest management policies which have created unhealthy forests and an influx of people moving to the wildland urban interface (WUI) (Pyne, 2004). With these two trends coming face to face, the potential impacts to property and life have become increasingly present and of major concern across the United States.

During the early part of the 20th century, two factors led to wildfire protection and policy (Nash, 2001; Pyne, 2004). First, forests had begun to be seen as an extremely important national resource and their protection was equated to national security (Pyne, 2004). Second, national attitudes toward undeveloped wilderness had begun to shift from ambivalence toward one of virility, aesthetic, and ethical values where forests were seen as places of solitude and preserved primeval character (Nash, 2001). Massive wildfires in Idaho, Montana, and Washington during the summer of 1910 threatened these notions and became a catalyst in the important debate around wildfire, creating forest fire policy, and sparking the first United States Department of Agriculture Forest Service (USFS) action in fighting wildfire (Pyne, 2004). Mandates set by the USFS which enforced full suppression of all wildfires on federal lands followed (Husari & McKelvey, 1996; United States Department of the Interior, 1995; Wildland Fire Leadership Council, 2011). For

instance, the 1926 Fire Protection Mission created an objective to control all fires before they reached 10 acres in size. A decade later, the 1935 "10 AM policy" required wildfires to be controlled by 10:00 a.m. the following morning of which they started (Husari & McKelvey, 1996; Wildland Fire Leadership Council, 2011). The philosopher William James, in his 1906 speech at Stanford University, used the phrase "moral equivalent of war" to signify how political entities maintain unity in the absence of war by creating a domestic enemy (James, 2013). These mandates and actions embody this ideal creating a war metaphor associated with wildland firefighting. This metaphor was ingrained into wildfire suppression actions and is still very much present today (Pyne, 2004, p. 52).

Fire suppression actions over the past century led to high fuel loads, a change in historic vegetation, and the growth of a vertical forest structure. Ultimately what resulted were unhealthy forests posing an increased wildfire risk (Office of Policy Analysis, 2012; Reiners, 2012). Specifically, under such conditions, when wildfires start they are more intense and quickly become unmanageable due to fire reaching the top branches of trees and turning into what is referred to as a crown fire (Agee & Skinner, 2005; United States Department of the Interior, 1995).

Over recent years, governmental entities have been dealing with mounting costs from fighting wildfires (Office of Policy Analysis, 2012). According to the National Interagency Fire Center (2015), 1985 saw total wildfire suppression costs of $240 Million as compared to $2.1 billion in 2015, reflecting almost a nine fold increase in 30 years. In contrast, national inflation has increased by only 2.2% during the same timeframe (U.S.

Bureau of Labor Statistics, n.d.). In 2015, 68,151 fires burned 10.1 million acres which destroyed 4,636 structures (National Interagency Coordination Center, 2015). It is not just safety and costs that are becoming a concern. The removal of natural historic wildfire regimes from the environment has been linked to negative impacts on wildlife, water quality, and water supply (Covington & Moore, 1994; Reiners, 2012).

While fire suppression policies over the past century led to changes creating increased wildfire risk; other changes in the way people related to forests were also occurring. Historically, people who lived in forested regions were directly connected to these resources through extraction industries such as logging. Today, with the influx of new, seasonal, and vacation residents, the local industry and economy are shifting from resource extraction to services providing for the needs of the new residents. These shifts have fueled a change of local attitudes toward the forest to one of a static amenity to be left untouched and appreciated (Collins & Bolin, 2009; Gordon, Matarrita-Cascante, Stedman, & Luloff, 2010). In addition, new residents moving to these areas are doing so because they want to be immersed in nature and surrounded by trees (Gordon et al., 2010). These changes in attitudes toward the forest are reflected by more people either buying second or vacation homes to get out of the city or retiring and moving to remote forested areas. Demand for homes located close to forests have fueled the growth of home construction in the WUI which has seen a 7% increase in acreage between 2000 and 2010 (Evans, 2015; Hammer, Stewart, Hawbaker, & Radeloff, 2009; Hammer, Stewart, & Radeloff, 2009; Radeloff et al., 2005).

Problem

With more people moving to the WUI every year, there is a confluence of people and property located adjacent to or within areas of extreme wildfire risk. To mitigate this risk, federal agencies and national coordination groups have developed programs such as Fire Adapted Communities and Firewise Communities that outline actions that can be taken by municipalities and homeowners on vegetation and structures (Fire Adapted Communities Coalition, n.d.; National Fire Protection Association, 2009). Through vegetation management of the property and modifications to structures, homeowners can reduce their risk to wildfire's impact as well as provide a safe and defendable space for firefighters (National Fire Protection Association, 2009). But homeowners may not perform these risk reduction activities due to many dynamic reasons. Understanding reasons and offering ways to gain better compliance with property mitigation are keys to the protection of life and property as well as creating more resilient communities.

Much about wildfire behavior from an ecological perspective exists in the literature (Agee & Skinner, 2005; Anderson et al., 2015; Brown et al., 2014; Covington & Moore, 1994; Hollis, Matthews, Anderson, Cruz, & Burrows, 2011; Kreye & Kobziar, 2015; Kreye, Kobziar, & Zipperer, 2013; Stevens, Safford, & Latimer, 2014; Tanase, Panciera, Lowell, & Aponte, 2015). Given the increased attention to wildfire risk and suppression, fire studies from a social science perspective have led to considerable research on wildfire mitigation behaviors of homeowners (Brenkert-Smith, Champ, & Flores, 2012; Martin, Martin, & Kent, 2009; McCaffrey, Stidham, Toman, & Shindler, 2011; McCaffrey & Winter, 2011; McNeill, Dunlop, Heath, Skinner, & Morrison, 2013).

From this research salient factors that provide consistent prediction of wildfire mitigation behaviors have been identified (Brenkert-Smith et al., 2012; Champ, Donovan, & Barth, 2013; Gordon et al., 2010; Martin et al., 2009; McCaffrey et al., 2011; McCaffrey & Winter, 2011; McNeill et al., 2013). These salient factors provide a foundation that should be included in any future research focused on mitigation behaviors. Yet, much still remains to be explored. First, studies that have a theoretical basis (Bourque et al., 2013; Brenkert-Smith, Dickinson, Champ, & Flores, 2013; Jakes, Kruger, Monroe, Nelson, & Sturtevant, 2007; Martin, Bender, & Raish, 2007) have offered many perspectives but the field has not coalesced on a specific or set of theories to explain this phenomenon (Bourque et al., 2013; Brenkert-Smith et al., 2013; Jakes et al., 2007; I. M. Martin et al., 2007; Martin et al., 2009). With an increasing focus on measuring beliefs, attitudes, norms, and intentions, the theory of reasoned action (Fishbein & Ajzen, 1975) and theory of planned behavior (Ajzen & Fishbein, 2005) appear most promising in assessing individual factors to understand the dynamics of mitigation behaviors (Bates, Quick, & Kloss, 2009; Vogt, Winter, & Fried, 2005; Winter, McCaffrey, & Vogt, 2009; Winter, Vogt, & Fried, 2002). An integrated theory that combines the theory of planned behavior with salient wildfire mitigation factors will go a long way in providing a measurement tool to understand local influences on homeowner performance of wildfire mitigation behaviors. Finally, Kruger (2002) suggested that social networks are important in the dissemination of information about wildfire risk and preparedness. Homeowner associations (HOA) may be that important link (McCaffrey et al., 2011). Research exploring the impact of HOAs on wildfire mitigation behaviors of homeowners

is very limited and what exists has emerged through qualitative studies (Monroe et al., 2013). No quantitative explorations of the influence of HOAs on wildfire mitigation behavior have been found in the published literature.

Purpose

Given these gaps, the purpose of this study is to a) test if the Theory of Planned Behavior provides a valid predictive model to test wildfire mitigation behaviors, b) develop and empirically test a wildfire mitigation theoretical framework that is based on the Theory of Planned Behavior and which incorporates the salient factors identified in past literature, and c) examine the role of HOAs on wildfire mitigation behaviors. The theoretical framework is intended to test diverse communities and identify the drivers behind homeowner mitigation behaviors. By developing a central framework incorporating all relevant wildfire mitigation factors, future research can begin to coalesce on a central theory and test its validity and reliability.

Besides providing a clear theoretical understanding, policy implications of the study will be two fold. First, by identifying community specific factors significantly related to mitigation actions, limited local resources could be focused in promoting these areas to gain better compliance by homeowners. Second, understanding the role of HOA's on homeowner mitigation behaviors will offer insight into their importance with a) linkages of information dissemination about wildfire mitigation actions from agencies to homeowners, b) regulation of mitigation actions, and c) eligibility for grant programs that provide money to homeowners for mitigation actions on private property. This will

be done by studying two populations, homeowners within an HOA and those not associated with an HOA.

Delimitations

This study was delimited to the following:

- Single family homeowners living in and around the city of Prescott, Arizona within the wildland urban interface. Multi-family dwellings (apartments, condos, and townhomes) and renters were excluded.
- Participants selected from two groups, neighborhoods with HOAs and those without.
- Factors (being measured in the study) that have been consistently identified as significant predictors of mitigation behaviors in past studies (personal experience, subjective knowledge, locus of responsibility, and perceived wildfire risk) and factors identified in testing the theory of planned behavior (beliefs, attitudes, subjective norms, perceived behavioral control, intentions to perform behavior, and actual behavior).
- The study will take a social science approach.
- Actual behaviors will be measured retrospectively.
- The City of Prescott and select unincorporated areas will be studied because of the areas high wildfire risk and its recognition as a model firewise community.

Limitations

As with any research, this study has certain limitations. The following discusses briefly these limitations and how the research is addressing the concerns.

- The study will implement a mail-back questionnaire with an online option for data collection modes. Differences between paper and on-line based questionnaire responses could present biases. It has been noted that there are little differences between the two modes and that it is more advantageous for the researcher to provide more opportunities for participants to respond (Dillman, Smyth, & Christian, 2009). McCaffrey et al. (2011) reported response biases based on demographic characteristics when comparing the two modes in a study using similar methods. To address the concerns of response mode bias, data will be compared across both modes to identify if any inconsistencies exist.
- Recent research has shown response rates to mail based questionnaires to be declining (Dillman et al., 2009; McCaffrey et al., 2011). Response rates around 35% have been achieved using similar sampling methods as proposed by this study (Bourque et al., 2013; Brenkert-Smith et al., 2012) which leaves a large segment of the population not included in the final analysis. To address non-response bias, data were reviewed for consistency with the intended population through available Census data.
- The population for this study was gleaned from Geographical Information System (GIS) parcel data layers acquired from Yavapai County. These data

provide parcel information found through the county's online parcel data base. Though the most updated information was acquired, it could have errors providing bad addresses. In addition, the methods used to pare down the specific populations for the study could introduce errors by including parcels along the boundaries of the WUI that are not actually in the WUI. This can happen due to overlapping polygons in the multiple data layers used. To test the population lists, a random selection of parcels will be selected and verified by cross-referencing them geographically to confirm they are within the desired population.

- The study will sample two independent groups of homeowners in an HOA and homeowners not in an HOA. Neighborhoods with HOAs will be identified by a local real-estate agent to inform a database that will be joined, geographically, to the parcel data through GIS. However, the two populations being studied limits generalizability of the results to other regions or across the sample. Though this is the design of the study and not necessarily a limitation, it is important not to make claims beyond the sample area.

Assumptions

In this study as with any, there are assumptions made by the researcher and methods selected. The following will outline these and provide context.

In the study of behaviors, specifically the use of theory of planned behavior, it is assumed that participants are rational individuals (Fishbein & Ajzen, 2010). In other words, participants are expected to think and act in a rational way to information that has

been presented to them. Participants will be asked about past behaviors related to wildfire mitigation. It is also assumed that responses will be truthful and that participants will clearly remember and report what actions they have taken in the past.

Giving the review of previous research, it is assumed that the research was sound and results provide explanation of relevant phenomenon which is implemented in this study. With a postpositivist worldview, the assumption is that the factors being measured and analyzed have real world relationships that can be explained by statistical methods through the use of theory. Therefore, it is assumed that the factors selected in this study work towards explaining intentions to behave in a certain way.

Definition of Terms

The following provides definitions of terms used in the proposal.

Attitude: "disposition or tendency to respond with some degree of favorableness or unfavorableness to a psychological object" (Fishbein & Ajzen, 2010, p. 76).

Behavior: Observable act or event that encompasses four elements; action to be performed, target that the action is directed towards, context that the action is performed in, and timeframe in which the action is performed in (Fishbein & Ajzen, 2010, p. 29).

Beliefs: Beliefs are defined in this study in terms of behaviors, injunctive norms, descriptive norms, and controls. Behavioral beliefs are defined as the "subjective probability that performing a behavior leads to a certain outcome" (Fishbein & Ajzen, 2010, p. 221). Injunctive normative beliefs refer to the "subjective probabilities that particular referents prescribe or proscribe performance of a behavior" (Fishbein & Ajzen, 2010, p. 221). Descriptive normative beliefs refer to "subjective probabilities that

particular referents are or are not performing the behavior" (Fishbein & Ajzen, 2010, p. 221). Control beliefs refer to "subjective probabilities that a particular factor that can facilitate or impede performance of the behavior will be present" (Fishbein & Ajzen, 2010, p. 221).

Fuel: The organic material that grows and accumulates as live and dead material that is susceptible to ignition (National Wildfire Coordination Group Training Working Team, 2006).

Homeowner: An individual or trust that holds deed to real property.

Homeowner Association, HOA (neighborhood association): According to the Arizona Revised Statutes, homeowner associations are defined as "a non-profit corporation or unincorporated association of owners that created pursuant to a declaration … that has the power under the declaration to assess association members to pay the costs and expenditures incurred in the performance of the association's obligations under the declaration"("Ariz. Rev. Stat. Prop. ," 2015).

Intention (behavioral intentions): The "readiness to engage in a behavior" (Fishbein & Ajzen, 2010, p. 43).

Mitigation (risk reduction): "The effort to reduce loss of life and property by lessening the impact of disasters" (Wildland Urban Interface Mitigation Committee, 2014, p. 9).

Neighborhoods: A residential area where people live near one another, usually with distinguishing characteristics. Boundaries often defined by planned development or physical features (*The American Heritage Dictionary*, 1985).

Norms (normative): Influence the social environment can exert on an individual's intentions and actions (Fishbein & Ajzen, 2010, p. 129).

Responsibility (locus of responsibility): A homeowner's perception of who is responsible for the protection of their property and the community from the risk of wildfire (Kent et al., 2003; Martin et al., 2009).

Risk (perception of risk): A homeowner's perceived risk that a wildfire could impact their life through evacuation, damage or loss of property, or loss of life (Kent et al., 2003; Martin et al., 2009).

Trusts: a property interest held by one or a group or person(s) for the benefit of another (*The American Heritage Dictionary*, 1985).

Wildfire (wildland fire): Fire burning in a natural environment that is not confined or controlled (Pyne, 1997).

Wildland Urban Interface/Intermix: The zone where undeveloped/unoccupied land transitions (*interface*) and intermingles (*intermix*) with structures and other human development (Wildland Urban Interface Mitigation Committee, 2014, p. 9).

LITERATURE REVIEW

This chapter reviews literature salient to wildfire mitigation behaviors. To provide context, the chapter starts with a discussion of fire dynamics and wildfire behavior followed by an examination of agencies and working groups involved in wildfire policy and management. The next section brings this information into focus by explaining the current dynamics and impacts of home ownership in the WUI. The following section centers around literature on wildfire mitigation and provides a theoretical context to studying these behaviors. The chapter concludes with the theoretical development of a wildfire mitigation model to address gaps in the literature.

Wildfire and Behavior

In understanding fire's impact on the natural and built environments, one must first have a basic knowledge of wildfire and its elements, ignition sources, and behavior. The following section provides a brief overview of fire and the elements involved in wildfire ignition and behavior.

The Fire Triangle

In order to have fire, three elements are required in what is called the "fire triangle" (National Wildfire Coordination Group Training Working Team, 2006). These elements are fuel to burn, air to supply oxygen to the flames, and heat which starts the combustion and continues the chemical reaction process (National Wildfire Coordination Group Training Working Team, 2006). In the natural environment, fuel is the organic matter that grows and accumulates as live and dead material. In the built environment, fuel can be houses, sheds, landscaping, etc. Oxygen provides the chemical needed for the

reaction to take place and for continued consumption of fuel to occur and is found readily in the air. Lastly, heat is needed to maintain the chemical reaction and also aids in drying materials for easier combustion. The fire will produce this heat which is transferred to the adjacent material. This movement of heat from one object to another is called heat transfer. Through radiation, convection, and conduction, heat, and subsequently fire, is transferred across the landscape. Fire cannot occur without a heat (ignition) source to start the chemical reaction. Ignition has naturally been by means of lightning striking the ground in North America but fire can also be caused from other natural and human events (National Wildfire Coordination Group Training Working Team, 2006).

If one of these three elements is removed from the environment, fire cannot exist. It is breaking this triangle which is at the most basic strategy of wildfire suppression. Strategies include the creation of fire breaks where the fuel is removed and a gap is created so the fire is incapable of preheating adjacent vegetation. Water is used to suffocate the fire depriving it from oxygen in addition to reducing the temperature (National Wildfire Coordination Group Training Working Team, 2006). Understanding the basics of fire is important in understanding how to mitigate one's property. As discussed later and in Appendix B, the many actions taken to reduce one's risk from wildfire are intended to remove one of the three elements. The natural environment can have a dramatic effect on how fire behaves and is the cause for how and where fire will spread.

Wildland Fire Behavior

Wildfire behaves very differently depending on the fuel characteristics, topography, and weather. Each one of these can interact with one another to create very unique fire behaviors. Fuels are what carry fire across the landscape, as described above, and the characteristic of fuel type, loading, availability, and arrangement will greatly determine the fire's behavior. The different fuel types will dictate if a fire is fast or slow burning and is of low or high intensity (National Wildfire Coordination Group Training Working Team, 2006).

Topography, defined as physical terrain or features of the landscape in a particular area dramatically influences wildfire behavior (National Wildfire Coordination Group Training Working Team, 2006). There are many topographical features that can affect fire including the aspect, slope, and shape of the terrain, such as the presence and type of canyons, ridges, saddles, and elevations (National Wildfire Coordination Group Training Working Team, 2006).

Weather is the last of the three major components of wildfire behavior and can be the cause of ignition and spread of fire. Air temperature, relative humidity, precipitation, atmospheric instability, and wind all play major roles in wildfire's behavior (National Wildfire Coordination Group Training Working Team, 2006).

Wildfire Management Agencies, Councils, and Coordination Groups

Managing wildfire requires a discipline focused on knowledge of its behavior and agencies working together. In the United States wildfire management is a function of many agencies and groups on national, state, and local levels. These agencies have

specific tasks but many manage public lands which they are required to protect. As discussed below, many national, state, and local agencies work very closely with one another through formalized councils and coordination groups. Appendix A provides an overview of national agencies involved in wildfire management and national policy that directly impacts wildfire's management.

This section discusses these agencies and groups. The section starts with a review of federal land and emergency management agencies with roles in national wildfire policy and management. Because the current study focuses on wildfire mitigation in and around the City of Prescott, Arizona, the section then reviews state of Arizona, county of Yavapai, and City of Prescott agencies and organizations that are involved in wildfire suppression, prevention, education, and/or disbursement of resources.

Federal fire management agencies include the U.S. Department of Agriculture, Forest Service (USFS); U.S. Department of Interior, Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), and Bureau of Indian Affairs (BIA); and the U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA). Each agency has specific roles nationally, either resource management or national security. All these agencies participate in wildfire policy and management either through protocol, support, or on the ground actions. Though beyond the focus of this dissertation, each agency has a rich history of wildfire policy and management. This history defines each agency's current management practices and policies.

In addition to the mentioned federal agencies are the international and national interagency groups, non-governmental advisory organizations, and counsels. These include the National Association of State Foresters (NASF), International Timber Counsel (ITC), International Association of Fire Chiefs (IAFC), National Fire Protection Association (NFPA), International Association of Wildland Fire (IAWF), National Interagency Fire Center (NIFC), National Wildfire Coordination Group (NWCG), and The Nature Conservancy (TNC). Many of these are associated with, or co-sponsored by, the federal agencies mentioned. In addition, they provide knowledge, policy development, and resource support to agencies and municipalities.

In Arizona, the State Forestry Division is the primary agency tasked with wildfire prevention and suppression activities on state trust and private lands. This state agency also provides education for communities in the state and training for state, county, and local firefighters. During wildfire incidences on state trust or private lands, the Arizona Interagency Dispatch Center, housed within the Forestry Division, manages the coordination and mobilization of resources for suppression activities. In addition to the wildfire suppression and prevention activities, the Forestry Division also works as a mediator between federal agencies and local fire departments and communities. The Division has three districts dividing the management of state forest resources including wildfire suppression. The Phoenix District manages the counties of Yuma, Maricopa, Lapaz, Gila, and Yavapai, which includes the City of Prescott (Arizona State Forestry, n.d.).

Fire protection in Yavapai County is managed by the Yavapai Fire District whose main jurisdictions are the unincorporated regions of the county as well as towns and cities which do not have a fire department ("Fire districts; powers and duties; definitions ", 2016). Though the regional fire districts will support the City of Prescott in wildfire fighting roles, the main responsibility of fire protection in the city is from the Prescott Fire Department (PFD). Established in 1885, the PFD provides structural and wildland fire suppression for the City of Prescott but is also involved in education of wildfire risk reduction actions for homeowners. PFD also works with local neighborhoods and residents to provide resources to dispose of debris removed from residential properties.

Besides the agencies, networks and coordination between the agencies is important. Many federal, state, and regional agencies have organized agreements to work collaboratively in wildfire protection, education, and mitigation. The Southwest Coordination Center (SWCC) is directed by the NIFC and NWCG and is one of ten regional coordination centers throughout the nation (Southwest Coordination Center, n.d.). SWCC comprises Arizona State Forestry, New Mexico State Forestry, BIA, BLM, NPS, USFWS, and USFS. In times of multiple wildfire incidences in this region, the Southwest Coordination Group (SWCG), a component of the SWCC and consisting of directors and managers from each of the cooperative agencies, assumes responsibilities of prioritization and allocation of resources and the creation of Incident Management Teams to manage the wildfires (Southwest Coordination Center, n.d.).

Fire Safe Councils

Fire Safe Councils (FSC) are another group of organizations focused on education, fuel reduction projects, resident and fire fighter protection, residential dwelling and structure protection, and overall protection of the community and environment (*Wildland Urban Interface Mitigation Committee*, 2014). Typically formed organically, FSC's can take many forms from a county wide multi-agency group with governmental memorandums of agreement to a small group of organized residents such as an HOA.

An active FSC in Yavapai County is the Prescott Area Wildland Urban Interface Commission (PAWUIC) which started as a grass roots movement by local residents and neighborhoods to promote wildfire awareness and mitigation after the Dose Fire threatened the area in 1990. That same year saw the loss of six firefighters' lives during the Dude Fire near the city of Payson, Arizona. Both fires brought awareness to the region's wildfire vulnerability. PAWUIC, now celebrating its 25th anniversary, continues to be a strong advocate in the region for wildland fire mitigation actions. The organization provides a link between the homeowners, national and state land management agencies, fire departments and districts, and city and county officials.

National Wildfire Mitigation Programs

Many of the mentioned agencies and coordination groups have developed and/or sponser programs that address the creation of safer communities through wildfire mitigation programs. These programs aim to form safer communities through reducing the impact of life and property from wildfire, creating a community that can recover

quicker after a disaster, reducing financial impact to individuals and the community, and reducing the risk to emergency response and firefighter personnel. These programs include Fire Adapted Communities, Living with Fire, Ready, Set, Go!, and Firewise Communities. For the purpose of this proposal, only Fire Adapted Communities and Firewise Communities will be reviewed as they are the more prominent programs in the City of Prescott.

Fire Adapted Communities

NWCG's Wildland Urban Interface Mitigation Committee (2014) defines a Fire Adapted Community (FAC) as "A human community consisting of informed and prepared citizen's collaboratively planning and taking action to safely co-exist with wildland fire" (p.11). FAC is not a specific program but provides an approach to becoming fire adapted. As a continual process of adaption, FAC requires buy in by all members of the community, adaption to changing conditions, and maintenance of the landscape and structures in the WUI. In this sense, risk is shared by all members in the community and thus everyone is responsible for the safety of all other community members through taking wildfire mitigation actions. When community members work to protect themselves, they also reduce the risk to adjacent properties. Taken collectively, if everyone is committed to the FAC approach, the community wildfire risk is greatly reduced.

Firewise Communities

The Firewise Communities program was developed by and is administered through the NFPA which continues to educate local homeowners about their individual

responsibility to protect life and property, teach how homeowners can mitigate their wildfire risk, and promote neighborhoods to work together and take action before a fire happens. The USFS, NASF are co-sponsors of the program. The program takes the FAC ideals and provides a flexible template for homeowners, HOA, and small towns in developing wildfire preparedness. The Prescott area not only has one of the first recognized Firewise Communities but has become a model community with over 26 registered communities. This designation provides avenues for these neighborhoods to receive federal grant money for mitigation work on private property.

NFPA (2009) identifies four principles to become firewise: 1) a family and home are prepared for fire inside and outside; 2) there is an understanding of the role and behavior of wildfire, and that the homeowner accepts responsibility for the way they live in the fire prone environment; 3) homeowners are making simple and sensible choices to protect life and property from wildfire; and 4) knowing all this, homeowners are taking action before a fire ever ignites. The Firewise Communities program promotes survivability of dwellings and neighborhoods by creating a defendable space around them. This is to provide two purposes; one is to allow local fire fighting agencies and wildland firefighters safe areas for dwelling fire protection. Second is preparing the house to survive a wildfire flame front if no resources were available to defend it. The area around the structure, also known as the "Home Ignition Zone" (Wildland Urban Interface Mitigation Committee, 2014, p. 16), should be prepared in such a way that there is limited impact to any dwellings. The NFPA also emphasizes that firewise is not a onetime action but a continual process which is required to minimize the impacts of

wildfire to life and property. Appendix B provides detailed information on the zones and specific actions that are identified by the NFPA Firewise Communities program.

Laws and Regulations

Homeowner's activity in performing wildfire mitigation actions have been suggested to be influenced by local and regional laws (Vogt, McCaffrey, & Winter, 2011; Winter et al., 2009). In developing an understanding of what influences mitigation behaviors, identify review of the laws and their potential impacts is needed. These are some of the laws and ordinances relating to wildfire mitigation for residents in the WUI around the Prescott area.

In the State of Arizona, laws and ordinances related to wildfire mitigation in the WUI are limited. There are no state wide laws enforcing those actions (Kurtz, 2006). The state gives local governments (counties, incorporated cities, and towns) the authority to adopt WUI codes from national or international organizations or associations (Adoption of codes by reference; limitations; method of adoption; fire sprinklers; fire apparatus access roads or approved routes; intent; state preemption; fire watch requirements; pool barrier gates, 2016; Wildland-Urban Interface Code, 2016). The City of Prescott adopted the 2012 International Wildland-Urban Interface Code for structures within the WUI enforceable by the PFD (Urban-Wildland Interface Code, 2015). New construction or modifications to existing structures require compliance to the code which regulates property vehicular access, structure construction materials, and vegetation management to create a defensible space (Urban-Wildland Interface Code, 2015). This does not enforce regular maintenance of vegetation for existing homes.

Theoretical Context

With a base understanding of the current wildfire mitigation landscape in the Prescott area, this chapter now transitions to current theories used to explain and measure mitigation behaviors. Wildfire mitigation studies have utilized a number of different theories which provide important insight into measuring and understanding behaviors. These include community capitals framework which has been used to explain the important elements of community wildfire preparedness (Jakes et al., 2007), health behavioral theories, including Protection Motivation Theory in predicting hazard mitigation and preparedness (Bourque et al., 2013), and an integrated protection motivation theory incorporating the transtheoretical model in understanding the subjective knowledge and risk perception on mitigation of wildfire hazard (I. M. Martin et al., 2007; Martin et al., 2009). A number of other studies have looked at policy, fuel management acceptance, and explanatory factors of wildfire mitigation behavior used the theory of reasoned action (TRA) to guide inquiry of results (Vogt et al., 2005; Winter et al., 2009; Winter et al., 2002). Lastly, the theory of planned behavior (TPB) was applied to the study of intention to protect the environment against wildfires and bushfire safety (Bates et al., 2009; Beatson & McLennan, 2011).

This study will utilize TPB in testing wildfire mitigation behaviors for the following reasons: a) there is a growing base of research investigating wildfire mitigation through TRA and TPB providing support for the theory's use (Bates et al., 2009; Beatson & McLennan, 2011; Winter et al., 2002), b) the integration of beliefs and intentions in the model has been shown to be reliable predictors of actual behaviors (Ajzen & Fishbein,

2005), and c) there is a strong base of research in multiple disciplines showing its applicability across diverse behaviors (Agarwal, 2014; Duangpunmat, Kalampakorn, & Pichayapinyo, 2013; Hanson, 1997; Heirman & Walrave, 2012; Jemmott, Jemmott, & Hacker, 1992; Kuther, 2002; Lowe, Watanabe, Baracos, & Courneya, 2012; Paek, Hilyard, Freimuth, Barge, & Mindlin, 2010; Seo, Kim, & Shim, 2014). The next sections will take a deeper examination of TRA and TPB.

Theory of Reasoned Action

Fishbein and Ajzen (1975) in their seminal book present the foundational underpinnings of beliefs, attitudes and behaviors in their development of the Theory of Reasoned Action (TRA). TRA pulls from many prominent theoretical perspectives used in social psychology including a number of learning theories, decision theory, classical conditioning models, dissonance theories, attribution theories, expectancy-value models, congruity theory, and balance theory. Most of these theories identified either beliefs and/or attitudes conceptually (Fishbein & Ajzen, 1975). From these theories and their conceptual relationships of variables from the attitudinal and behavioral research, Fishbein and Ajzen solidified the competing theories and developed the TRA. The TRA has performed well in researching many different behaviors (Chen & Chen, 2006; Doane, Pearson, & Kelley, 2014; Marandu, 2009; Terry, Gallois, & McCamish, 1993).

TRA revolves around three major concepts of affect, cognition, and conation. Fishbein and Ajzen (1975) identify affect as "a person's feelings and evaluation of some object, person, issue, or event." Cognition is defined as a person's "knowledge, opinions, beliefs, and thoughts about the object [person, issue, or event]." Conation is defined as a

person's "behavioral intentions and [their] actions with respect to or in the presence of the object [person, issue, or event]" (Fishbein & Ajzen, 1975, p. 12). These concepts provide an important foundation for TRA as they define the factors that predict intention. Intention is theorized to directly link to actual behavior. By separating the concepts of intention to perform and actual behavior, the theory focuses on a person's predisposition to behave in a certain way. Attitudes directly predict a person's intention which is used to predict actual behavior. In other words, the concepts of cognition, affect, and conation are referring to a person's beliefs, attitudes, and intentions respectively; while the behavior is an explicit activity which cannot always be measured as it may be a future action. The factors identified in the TRA are beliefs which represent opinions and beliefs (cognition), attitudes which represent feelings and evaluations of the object (affect), intention which represents behavioral intentions (conation), and actual behavior which represents observed overt acts. Figure 1 presents a structured example of TRA. In the causal model, and working backwards, behaviors are predicted by intentions to perform the behavior which in turn are predicted by two direct measures of attitude toward the behavior and subjective norms concerning the behavior. Each direct measure is predicted by an indirect measure of beliefs. In other words, attitude toward the behavior is predicted by beliefs about consequences of the behavior and subjective norms are predicted by normative beliefs about the behavior. The authors, Fishbein and Ajzen, present this in a context which they view people as rational and who utilize the information available in order to form their attitudes and beliefs, which allows them to decide to behave in a certain way.

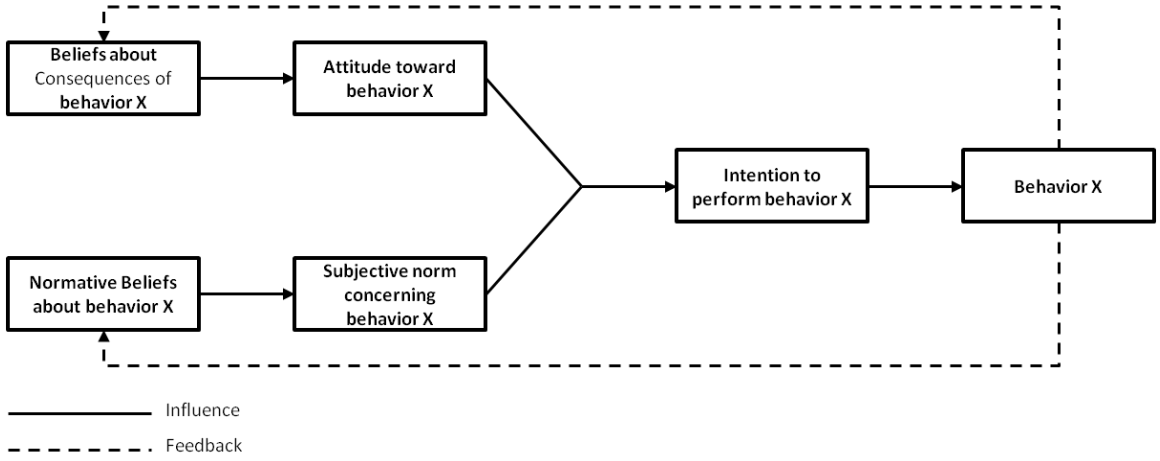


Figure 1. Fishbein and Ajzen (1975) Theory of Reasoned Action

TRA is a well tested theory and has been used in many disciplines for understanding human behaviors. The health and medical field identified the usefulness of the theory and applied it to many different situations including: AIDS prevention (Terry et al., 1993), condom use (Marandu, 2009), receiving vaccinations (Cuevas & Romero, 2010), organ donation (Jeffres, Carroll, Rubenking, & Amschlinger, 2008), dieting (Shepherd & Towler, 2007), and smoking (Noonan, Kulbok, & Yan, 2011). TRA has also been used to understand social issues related to domestic violence (Sulak, Saxon, & Fearon, 2014), driving while under the influence (Gastil, 2000), and gambling (Thrasher, Andrew, & Mahony, 2011). Use of internet based technology is a relatively new area of study which has utilized TRA as an approach to understanding behaviors to engage in certain activities including use of information technology (Al-Suqri & Al-Aufi, 2015; Mishra, Akman, & Mishra, 2014), software piracy (Aleassa, Pearson, & McClurg, 2011), cyber bullying (Doane, Pearson, & Kelley, 2014), and on-line teaching (Chen & Chen, 2006). In addition, research has applied the TRA in understanding purchasing

behavior (Tsai, Chin, & Chen, 2010), retirement saving behavior (Liou & Leech, 2010), workplace misbehavior (Vardi & Weitz, 2002), job application decisions (Van Hooft, Born, Taris, & Van der Flier, 2006), and renewable energy adoption (Bang, Ellinger, Hadjimarcou, & Traichal, 2000). Research has also been expended into the recreation (Bright, 2003) and tourism (Kim, Kim, & Goh, 2011) fields.

Pertinent to this study, TRA has also been applied to wildfire mitigation looking at homeowners' acceptance and intentions to approve fuel management approaches and government policies focused on mitigation behaviors (Vogt et al., 2005; Winter et al., 2009; Winter et al., 2002). Studies have identified that support for fuel management strategies is positively related to homeowners' perceptions of positive outcomes of the fuel management actions. Trust has been identified as an important element in this acceptance of agency strategies that centers on planning, competency, and citizen participation (Winter et al., 2002). In a qualitative study using TRA as a conceptual model, homeowners have a higher acceptance to mandatory regulations of wildfire mitigation than previously anticipated. There are many themes the studies identified that were associated with acceptance of regulation including level of perceived risk, the understanding that the risk is shared by the whole community, a sense of fairness that the policies apply to all including residence and government, and compliance is enforced (Winter et al., 2009). In acceptance of fuel management approaches, a modified TRA model was found to predict intentions to approve a particular management approach. Trust, importance of fuel management approach, beliefs about the outcomes of the management approach, and attitudes toward fuel management approach were found to be

significant and positively related to intention to approve fuel management approach. The latter two factors, beliefs and attitudes, were key elements in the TRA (Vogt et al., 2005).

Theory of Planned Behavior

TRA has limitations in its ability to explain the many dynamics involved in human behavior. For instance, even though a person might have a positive attitude toward the behavior and believes people important to him/her view that behavior as positive, there are circumstances where the individual does not intend to perform the behavior. Ajzen (1988) conceptualized that an individual's perception of enabling or restricting controls were an important factor that could aid or limit his/her intention to perform the behavior. He proposed adding a control dimension to TRA in an effort to better explain a person's intention to perform a behavior. The concept is defined as perceived behavioral control, which seeks to understand a person's evaluation, either positive or negative, of beliefs that they have the tools and skills to perform the behavior in question (Ajzen, 2005). The extension of TRA is called the Theory of Planned Behavior (TPB) and incorporates the previous TRA dimensions as well as an additional direct measure of perceived behavioral control which is a predictor of intention to perform the behavior. Like the TRA direct measures, perceived behavioral control is predicted by an indirect measure of control beliefs. The control beliefs are identified as the belief about the presence of factors that may facilitate or impede performance of the behavior (Fishbein & Ajzen, 2010). TPB introduces a measure of actual behavioral control which can moderate intention's prediction of behavior. Actual behavioral control refers to the physical (external) factors that enable or restrict behaviors which the

individual does not have control over. Perceived behavioral control is the psychological (internal) perception of factors which facilitate or impede intentions to perform a behavior. Actual behavioral control can also influence perceived behavioral control as shown in Figure 2. The dashed lines in the model suggest the relationship may not be relevant in all studies or explained through other measures and relationships. Fishbein and Ajzen (2010) identifies that actual behavioral control can be difficult to measure for most behaviors. Research has shown that perceived behavioral control is a reliable proxy for actual control (Conner, Warren, Close, & Sparks, 1999; Sheeran & Orbell, 2000).

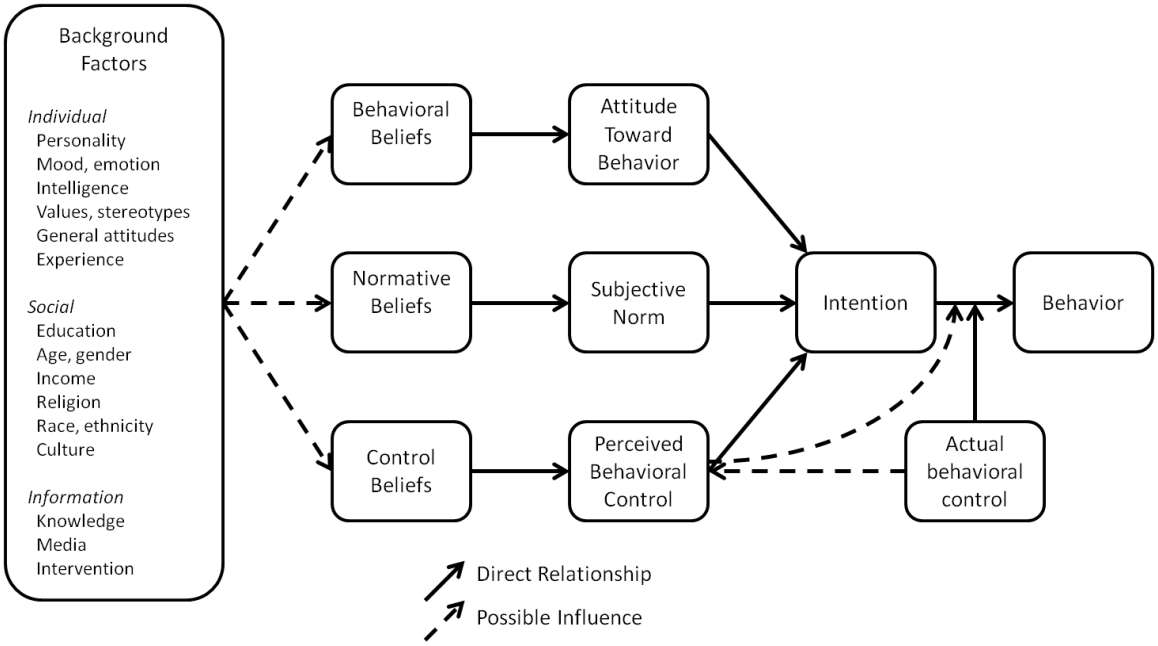


Figure 2. Ajzen (2005) The Theory of Planned Behavior

Additionally, TPB builds on the TRA by also including background factors which Ajzen (2005) divided into the three categories of individual, social, and information (see Figure 2). Background factors are external to the TPB model. Ajzen notes that background factors that may influence behaviors, do not necessarily have a direct

connection to behaviors. Even when demographic background factors are found to have a significant direct effect on behaviors, the relationship is greatly reduced or no longer significant when intentions and behavioral controls are taken into account. In other words, background factors tend to be indirectly related to behaviors and are typically captured in the proximal measures of behaviors (Fishbein & Ajzen, 2010). Background factors can include an array of items. Ajzen (2005) suggests a few background factors in the general TPB model for examples but notes that the domain of interest and associated theory should be used to identify the relevant factors to be measured in individual studies.

Like TRA, TPB has also been applied in many different disciplines and applications. Researchers in health and medicine were early adopters of TPB with extensive literature on vaccination acceptance (Agarwal, 2014; Frew et al., 2012), STD and condom use (Abamecha, Godesso, & Girma, 2013; Jemmott et al., 1992; Kasprzyk & Montano, 1998), substance abuse (Gallucci, Martin, Beaujean, & Usdan, 2015; Huchting, Lac, & LaBrie, 2008; Kam, Matsunaga, Hecht, & Ndiaye, 2009; Kuther, 2002), physical activity and fitness (Duangpunmat et al., 2013; Gulley & Boggs, 2014; Hagger et al., 2007; Kerner, Grossman, & Kurrant, 2001; Martin, Oliver, & McCaughtry, 2007; Nguyen, Potvin, & Otis, 1997), physical activity in cancer patients (Karvinen et al., 2009; Keats, Culos-Reed, Courneya, & McBride, 2007; Lowe et al., 2012), smoking (Hanson, 1997; Hill, Boudreau, Amyot, Dery, & Godin, 1997), diet (Hackman & Knowlden, 2014; Kim, Reicks, & Sjoberg, 2003; Rah, Hasler, Painter, & Chapman-Novakofski, 2004; Seo et al., 2014), hygiene (McLaws, Maharlouei, Yousefi, & Askarian, 2012; O'Boyle, Henly, & Larson, 2001),and blood and organ donation (DuBay et al., 2014; Polonsky, Renzaho,

Ferdous, & McQuilten, 2013; Robinson, Masser, White, Hyde, & Terry, 2008). Bullying (Heirman & Walrave, 2012) and sexual harassment and abuse (Li, Frieze, & Tang, 2010) have been studied through the lens of TPB. In a tourism context, Cheng, Lam, and Hsu (2006) showed how TPB gave new insight into negative word of mouth intentions of Chinese restaurant customers in a Chinese business environment. Emergency preparedness and communication was studied using TPB by Paek et al. (2010).

Though still limited, there is growing literature using the TPB to measure and identify important factors related to wildfire mitigation behavior. Bates et al. (2009) used TPB to understand how knowledge predicted homeowners' attitudes, subjective norms, and perceived behavioral control in the prediction of behavioral intentions on protecting the environment and their home against wildfires. Their study looked at the influence of knowledge on TPB, but found limited support with knowledge having a significant negative influence on subjective norm and a positive influence on perceived behavioral control. Of the three factors in TPB, only perceived control was a significant predictor of behavioral intentions to protect the environment and homes against wildfire.

Actual Mitigation Behavior

Mitigation behavior is the central concept of interest in this study. Literature has described this as risk reduction behaviors (Martin et al., 2009), hazard reduction (Collins & Bolin, 2009), risk/wildfire preparedness (Bourque et al., 2013; Jakes et al., 2007; McNeill et al., 2013), wildfire/wildland fire mitigation decisions (Brenkert-Smith, 2011; Brenkert-Smith, Champ, & Flores, 2006), mitigation actions/activities (Champ et al., 2013; Faulkner, Mcfarlane, & Mcgee, 2009; McCaffrey et al., 2011; McCaffrey &

Winter, 2011; McFarlane, Mcgee, & Faulkner, 2011), and mitigation behaviors (Brenkert-Smith et al., 2012). These terms are generally described as the actions a homeowner takes to reduce their risk from the negative impacts wildfire can have on life and property.

Literature has suggested the influence of previous mitigation activities can reduce ones likelihood of performing future actions due to a lower sense of risk (McCaffrey et al., 2011; McCaffrey & Winter 2011). This can be from either maintenance actions taken which provide a temporary sense of risk reduction or one time capital improvements to the home. Importantly, this suggests a feedback relationship of actual mitigation behaviors with risk perceptions.

Literature has identified many factors that describe and predict homeowner wildfire mitigation behaviors. Identifying the significant factors is paramount in an attempt to reduce risk from wildfire. In this current study, these significant factors are conceptualized as internal and external factors. The next section review the current literature in these areas as it relates to actual wildfire mitigation behaviors.

Internal Factors of Wildfire Mitigation Behavior

Internal factors relate to the predictors of wildfire mitigation behaviors that are cognitive in nature or in one's mind. These are influenced by life experiences which impact their beliefs, attitudes, and perception of risk reduction behaviors. Salient factors identified from the literature include direct experience with wildfire (Brenkert-Smith et al., 2012; Champ et al., 2013; McCaffrey et al., 2011; McCaffrey & Winter, 2011), subjective knowledge (Bourque et al., 2013; Champ et al., 2013; Martin et al., 2009;

McCaffrey et al., 2011; McCaffrey & Winter, 2011), information to homeowners on wildfire and its risks (Brenkert-Smith et al., 2012; McCaffrey et al., 2011), locus of responsibility (Gordon et al., 2010; Martin et al., 2009; McCaffrey & Winter, 2011; McNeill et al., 2013), and risk perceptions (Brenkert-Smith et al., 2012; Champ et al., 2013; Gordon et al., 2010; McCaffrey et al., 2011; McNeill et al., 2013). The following will cover each factor in more detail.

Personal Experience and Subjective Knowledge

Literature is mixed on the dimension of direct experience's influence on homeowner mitigation actions. Personal experience has been identified as one of the leading sources for learning about wildfire risk (McCaffrey et al., 2011). Though this is a difficult way to learn, these experiences with a home in direct physical risk or need for evacuation has been shown to be an important factor in actively performing mitigation behaviors (Brenkert-Smith et al., 2012; Champ et al., 2013). In contrast, other studies found mitigation behaviors not to be explained by prior experience with wildfires (Martin et al., 2009). Experience with fire ten miles away was also found not to provide significantly to mitigation behavior (Brenkert-Smith et al., 2012).

The central idea of subjective knowledge seeks to understand what individuals believe they know about a potential risk (Martin et al., 2009) through identifying information sources, such as social interactions (Martin et al., 2009; McCaffrey et al., 2011). Knowledge of wildfires has been found to have a significant and positive relationship to risk reduction behaviors (Bourque et al., 2013; Martin et al., 2009). Studies have identified a number of key information sources that directly develop

wildfire knowledge including neighbors and informal social interactions (Brenkert-Smith et al., 2006), homeowner associations, agency outreach, and local fire departments (Brenkert-Smith et al., 2012; McCaffrey et al., 2011).

Locus of Responsibility

Attitude toward the responsible parties for risk reduction actions has been identified often in the wildfire mitigation literature. Responsibility falls on a continuum between homeowners to government agencies. Homeowners in qualitative studies identified that the landowner (including government land management agencies) is responsible for mitigation of their land to reduce the risk of wildfire. This suggests homeowners believe that it is their responsibility to perform risk reduction activities (McCaffrey et al., 2011; McCaffrey & Winter, 2011). However, studies have shown that length of residency can play a role in homeowners' sense of responsibility with long-time residents identifying a greater sense of self reliance and awareness from experience of past fires, while new residents, especially those in gated communities, identified that the "experts" or government were more responsible for managing their risk (Gordon et al., 2010). Individual responsibility has been shown to be a significant predictor of risk reduction behavior (Martin et al., 2009). Other studies have shown that protection responsibility was not a significant predictor of mitigation behaviors (McNeill et al., 2013).

Risk Perceptions

Risk perception, which Slovic (1987) defines as intuitive risk judgments, is an innate human response that is used to help our survival. In the risk mitigation literature,

risk perceptions have been consistently identified as an important factor in understanding wildfire mitigation behaviors (Brenkert-Smith et al., 2012; Champ et al., 2013; Martin et al., 2009; McNeill et al., 2013). Risk perception in the wildfire literature is defined as the perceived probability that some future wildfire event will occur and negatively impact an individual's person or property. A relationship was found between perceptions of wildfire risk and the density of vegetation on the property (Brenkert-Smith et al., 2012). Brenkert-Smith et al. (2012) found homeowners who identify increased risk should be more likely to conduct wildfire mitigation activities. Risk perceptions have also been shown to be a mediator between salient factors and risk reduction behaviors (Martin et al., 2009). In addition, studies have found that risk perceptions were lowered after performing mitigation activities (McCaffrey et al., 2011). This suggests a reciprocal causation between risk and mitigation behaviors.

External Factors of Wildfire Mitigation Behavior

External factors are centered on the physical environment, which are salient to wildfire mitigation behaviors. The factors identified in the literature include homeowner demographics (Brenkert-Smith et al., 2012; Champ et al., 2013; Collins & Bolin, 2009; Gordon, Luloff, & Stedman, 2012), residency, including permanent and part-time residents (Collins & Bolin, 2009; Gordon et al., 2010; Martin et al., 2009; McCaffrey et al., 2011), length of residency (Collins & Bolin, 2009), parcel characteristics (Brenkert-Smith et al., 2012; Champ et al., 2013), risk reduction programs and policies (Collins & Bolin, 2009; Vogt et al., 2011), and HOAs (McCaffrey et al., 2011). The following section provides a review of these factors.

Demographics

Demographic measures are a set of variables collected in most studies to identify differences, control for variations, or to determine mediation of other predicting variables. In the wildfire mitigation behavior literature, demographic variable and their interactions have been found to intertwine with perceived vulnerability and risk of wildfire (Gordon et al., 2010). A couple of key demographic variables have been consistent predictors of mitigation behaviors. Homeowners' age has been identified as one of these significant demographic variables, but literature is mixed on its relationships to wildfire mitigation behaviors with some studies suggesting a positive relationship (Brenkert-Smith et al., 2012; Collins & Bolin, 2009) and others a negative relationship (Champ et al., 2013). Homeowner's income is a common significant and positive predictor in mitigation models (Brenkert-Smith et al., 2012; Champ et al., 2013; Collins & Bolin, 2009).

Residence (seasonality and length)

In relation to residency, two factors have emerged from wildfire mitigation literature, full-time/part-time and length of residence. Full-time/part-time residence examines the dynamics involved between attitudes of local residents and amenity migrants (Collins & Bolin, 2009), snowbirds and in-migrants (Gordon et al., 2010), and seasonal and vacation residents (Martin et al., 2009).

Length of residence is identified as a resident's status, either full-time or part-time residency, within a community (Collins & Bolin, 2009; Gordon et al., 2010). Literature has identified how part-time residents have a lack of experience and low perception of

wildfire risk, purchase real estate in the WUI for its natural amenities, and feel insurance is a comparable substitute to mitigation activities (Collins & Bolin, 2009; Gordon et al., 2010; McCaffrey et al., 2011). The full-time/part-time and long-time/new resident dynamics present some important issues with historical extractive and development uses of the natural resources. Many new residents are imposing different ideas of natural resources as an aesthetic amenity which should be protected (Gordon et al., 2010). This view of nature as an amenity helps to explain some of the differences of attitudes in performing mitigation activities. Both seasonality (full-time/part-time residence) and length of residency have been found to be significant and positive predictors of mitigation behaviors (Collins & Bolin, 2009).

Parcel and Dwelling Characteristics

Parcel and dwelling characteristics are unique factors that have not been tested in many studies, but pose an important dynamic in the greater idea of wildfire mitigation. Parcel characteristics have been measured in the literature as the size of the lot (Brenkert-Smith et al., 2012), vegetation density, vegetation distance from structure, topography, distance of topography from structure, average slope within 150 feet of house (Champ et al., 2013), land value, and gated enclave (Collins & Bolin, 2009). Dwelling characteristics have been measured as roof type (Champ et al., 2013), year of home construction, isolated cabin, mobile home park, apartment complex, condominium complex, and dwelling dollar value (Collins & Bolin, 2009). For parcel characteristics, the literature has identified lot size as having a significant and positive relationship with wildfire mitigation while gated enclave as having a significant and negative relationship

(Brenkert-Smith et al., 2012; Collins & Bolin, 2009). Roof type and dwelling dollar value were both significant and positive predictors of behavior (Champ et al., 2013; Collins & Bolin, 2009). Though only a few parcel and dwelling characteristics were significant predictors of mitigation behaviors, physical circumstances may still be needed in a larger mitigation behavior setting.

Programs and Policies

The influence of programs and policies related to wildfire mitigation play an important role in homeowner mitigation behaviors. Literature identifies programs and policies as government sponsored laws, voluntary programs provided to residents, and actions required by insurance companies (Faulkner et al., 2009; Vogt et al., 2011; Winter et al., 2009). Studies have shown the locations with laws requiring homeowner mitigation activities create more motivation by homeowners to perform these behaviors and they tend to view their actions as effective (McCaffrey & Winter, 2011; Vogt et al., 2011). However, homeowner apathy toward mitigation behavior has been identified by a lack of government programs, policies, and awareness (Gordon et al., 2012; Vogt et al., 2011). Insurance is often viewed as an appropriate risk management tool, but many also view this as a substitute for performing wildfire mitigation activities. Moreover, insurance companies are becoming a catalyst for homeowners performing mitigation behaviors by requiring policy holders to complete certain action to help protect their property (Collins & Bolin, 2009; Vogt et al., 2011). Going beyond programs and policies, the idea of agency trust was suggested by Winter et al. (2002) in acceptance of fuel treatments. Factors related to trust revolved around an agency's ability to control

fires and their professional skills, credibility, and communication. In all, governmental and policy factors concerning wildfire mitigation has been shown to be an important predictor of mitigation intentions among homeowners.

Homeowner Associations

Wildfire mitigation literature is limited in understanding HOAs' impact on these behaviors. Only a few qualitative studies have identified the impact of HOAs on wildfire preparedness (McCaffrey et al., 2011; Monroe et al., 2013). In a wildfire preparedness context, behavioral change to increase risk reduction activities of residents is most effective through neighborhood leaders who can extend information about wildfire risk and mitigation to residents of the neighborhood (Monroe et al., 2013). Strong social capital can be a catalyst to behavioral change emphasizing the importance for social cohesion and networks within the neighborhood (Monroe et al., 2013). Neighborhoods that are organized and connected have more opportunities for access to important information about the risks and how to mitigate them. Through these communication channels, HOAs are an important information source and motivation factor for homeowner mitigation actions. In neighborhoods without associations, governmental and agency programs that work directly with residents have been shown to successfully promote mitigation actions (McCaffrey et al., 2011). This shows that direct interaction with individual homeowners is important in influencing mitigation behaviors. In other words, HOAs provide this direct link which could be missing in most non-HOA neighborhoods. In understanding homeowner wildfire mitigation behaviors, the roles HOAs play in this informational linkage is key.

Gaps in the Literature

The literature has begun to develop a solid understanding of how various factors and variables influence wildfire mitigation behaviors. Theory used to explore this phenomenon is varied and not unified, although there is a growing base of research using the reasoned action approach as a theoretical foundation.

In the wildfire mitigation literature, there is not a common set of salient factors that are assessed across studies. In an effort to carry the field forward, a common set of salient factors or variables in measuring mitigation behaviors needs to be identified. Though all factors may not be significant for every community, there is a need to be able to measure all relevant factors through an integrated theoretical model to understand the unique dynamics of individual communities.

Additionally, the wildfire mitigation literature has limited research on the impacts of HOAs on wildfire mitigation behaviors. Studies have identified that HOA's play a role as identified in McCaffrey et al. (2011) qualitative study. However, details regarding HOA's role in homeowner mitigation behaviors need to be further explored.

The Wildfire Mitigation Behavior Model

To fill these gaps, this study proposes the development and testing of a theoretical model based on the TPB outlined by Ajzen (2005). The proposed model incorporates key wildfire mitigation factors identified in the literature to gain a complete understanding of mitigation intentions and behaviors. The conceptual model is identified as the Wildfire Mitigation Behavior Model (WMB) shown in Figure 3.

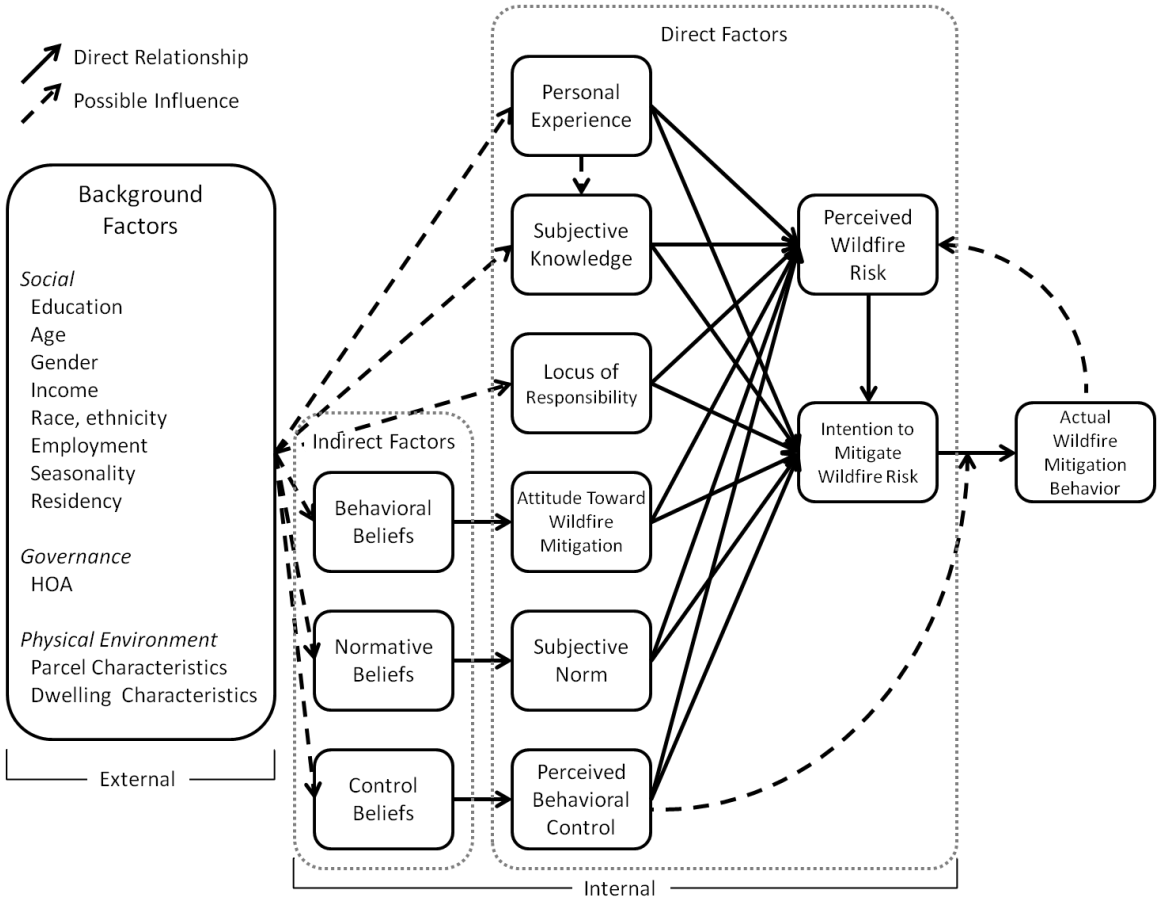


Figure 3. Conceptual Wildfire Mitigation Behavior Model

The TPB model provides the main conceptual foundation for the understanding of homeowners' mitigation behavior in the WMB model. In this context, the dimensions identified earlier in the TPB remain. TPB has been expanded to include the salient factors identified in the wildfire mitigation literature. The following sections will discuss these and provide explanation for the inclusion or exclusion of each factor presented in the model.

Model Factors and Measures

As mentioned, the TPB factors provide the basis of the proposed model. The basic structure of beliefs, attitudes, subjective norms, perceived behavioral controls,

intention to mitigate wildfire risk, and actual wildfire mitigation behavior are as outlined above in the TPB discussion. Beyond the basic TPB model, a number of key factors from the literature have been added to the model for a more comprehensive understanding of homeowner's intention to perform mitigation behaviors. These include personal experience (Brenkert-Smith et al., 2012; Champ et al., 2013; McCaffrey et al., 2011; McCaffrey & Winter, 2011), subjective knowledge (Bourque et al., 2013; Champ et al., 2013; Martin et al., 2009; McCaffrey et al., 2011; McCaffrey & Winter, 2011), locus of responsibility (Gordon et al., 2010; Martin et al., 2009; McCaffrey & Winter, 2011; McNeill et al., 2013), and perceived wildfire risk (Brenkert-Smith et al., 2012; Champ et al., 2013; Gordon et al., 2010; McCaffrey et al., 2011; McNeill et al., 2013). There are background (external) factors that could impact the concepts in the model and their ability to predict intentions. These include the social category as described by Ajzen (2005) and a governance and physical environment category. The individual and information categories of the original TPB background factors were not included in part because personal experience and subjective knowledge have been placed in the model as predictors. Others, such as intelligence, stereotypes, and intervention were beyond the scope of this study. The following will briefly discuss the factors in the model beyond the TPB factors.

Personal experience brings the direct impacts that a homeowner has had from wildfire into the model, including from proximity, evacuations, personal loss of property, or personal loss of life (Brenkert-Smith et al., 2012; Champ et al., 2013; McCaffrey et al., 2011; McCaffrey & Winter, 2011). In the model, personal experience is directly related

to intention to mitigate wildfire risk and perceived wildfire risk based on the relationships presented in previous literature (Brenkert-Smith et al., 2012).

Subjective knowledge is the information a homeowner gathers through a multitude of sources including literature, social connections, and indirect experience (Bourque et al., 2013; Champ et al., 2013; Martin et al., 2009; McCaffrey et al., 2011; McCaffrey & Winter, 2011). In the model, subjective knowledge is directly related to perceived wildfire risk and intention to perform mitigation behaviors based on the relationships identified in previous literature (Martin et al., 2009).

One dimension that seemed quite prevalent in the wildfire mitigation literature was the concept of locus of responsibility. Including this dimension in the WMB is hypothesized to improve the understanding of mitigation behaviors and perceptions of risk by addressing homeowners' sense of personal responsibility to protect themselves and property from the impacts of wildfire (Gordon et al., 2010; Martin et al., 2009; McCaffrey & Winter, 2011; McNeill et al., 2013). Personal responsibility is included to understand intention to perform mitigation behaviors and perceived level of risk (Martin et al., 2009), but this factor is also indicative of homeowner's perception of governmental and local agency responsibility. For instance, studies have shown that homeowners felt it was not the government's job to maintain their property; therefore, the responsibility was left for the homeowner to mitigate (McCaffrey et al., 2011; McCaffrey & Winter, 2011; Martin et al, 2009). A person's locus of responsibility has been identified in the model to directly relate to perceived risk and intention to perform mitigation behaviors based on previous literature (Martin et al., 2009).

Perceived wildfire risk is one of the central factors in this modified model, which aids in explaining intention to mitigate. The wildfire mitigation literature has identified perceptions of risk as a key element in understanding homeowner's behaviors (Brenkert-Smith et al., 2012; Champ et al., 2013; Gordon et al., 2010; McCaffrey et al., 2011; McNeill et al., 2013). In this model, perceived risk is predicted to be a mediator between the dimensions of personal experience, subjective knowledge, locus of responsibility, attitude toward the behavior, subjective norms, and perceived behavioral control and intention to mitigate wildfire risk. This mediation is suggested to provide a better explanation of intention to mitigate wildfire risk (Martin et al., 2009). Actual wildfire mitigation behaviors also have a possible influence on perceived wildfire risk as suggested in previous empirical literature (McCaffrey et al., 2011). To account for this relationship, actual mitigation behaviors are hypothesized to have a direct influence on perceived wildfire risk.

Actual behavioral control is not included in the model because of the difficulty in identifying and measuring the factor. Fishbein and Ajzen (2010) identify that actual behavioral controls are often immeasurable. They note that the use of perceived behavioral control can be used as a proxy to measure actual control.

Background Factors

The model includes background (external) factors, which are important in the wildfire mitigation literature. These factors influence on the greater model is an important part of understanding homeowners' mitigation behaviors. Background factors include three categories: social, governance, and physical environment.

Ajzen (2005) identifies that background factors influence the TPB model but these factors may not have a direct connection to the other model factors. Ajzen (2005) identifies the inclusion of pertinent factors to the area of study. For this study, background factors have been identified in the literature and included in the background factors of the WMB while ones beyond the scope of this study have been removed.

The social category is intended to provide influences of the model factors that pertain to demographics and community dynamics. These include education, age, gender, income, race, ethnicity, employment, seasonality, and residency. Age, gender and race/ethnicity are self explanatory; and education is defined as the level of formal education the homeowner has obtained. Income provides a measure of social-economic status by providing the total household income. Employment is defined as the homeowners status as working a full-time or part-time job or as retired. Seasonality is included to gain information about the homeowner's use of the property as either a full-time or seasonal residence. Lastly, residency is defined as the length of time a homeowner has lived in the residence located in the WUI.

TPB also identifies a background factor category of information. The factors in this category were in part focused on homeowner knowledge and experiences. Since subjective knowledge and personal experience are already direct measures in the model, this category has been dropped from the background factors. A physical environment category has been added to the background factors based on the influence of parcel and dwelling characteristics on mitigation behavior (Brenkert-Smith et al., 2012; Champ & Brenkert-Smith, 2016; Collins & Bolin, 2009). In an effort to begin understanding the

influence of HOAs on mitigation behaviors, a governance category has been included in the background factors, which includes an HOA factor. HOA is assessed to identify the presence and strength of homeowner associations that may be present in the neighborhood.

Research Questions

To test the model presented and address the gaps identified in the literature, this study will explore four research questions:

1. Does the theory of planned behavior provide a valid predictive model for the assessment of homeowner wildfire mitigation behaviors?
2. Does the wildfire mitigation behavior model provide a valid predictive model that fits the data better than the theory of planned behavior for the assessment of homeowner wildfire mitigation behaviors?
3. Does perceived wildfire risk mediate the relationship between model predictors and intention to mitigate wildfire risk?
4. Does homeowner association membership significantly influence homeowner mitigation behaviors?

To test the WMB, the study must first identify the TPB as an adequate foundational theory for predicting wildfire mitigation behaviors of homeowners. Therefore, the study will first examine the validity of TPB as an acceptable model in the context of homeowner wildfire mitigation behaviors as represented in Figure 4. The second research question of the study identifies if the WMB provides a better framework than the TPB alone. Figure 5 represents the WMB being tested with TPB and the

inclusion of salient wildfire mitigation factors. The third research question addresses perceived wildfire risk as a mediator between the model predictors and intention to mitigate wildfire risk (Figure 6). The fourth and last research question of the study explores the difference in wildfire mitigation behaviors between neighborhoods with and without HOAs. Based on these research questions, the following hypotheses will be tested.

H1a: The belief factors of behavioral beliefs, normative beliefs, and control beliefs will have a significant and positive relationship with their associated factors of attitude toward wildfire mitigation, subjective norm, and perceived behavioral control (Figure 4).

H1b: Attitude toward wildfire mitigation, subjective norm, and perceived behavioral control factors will have a significant and positive relationship with intention to mitigate wildfire risk (Figure 4).

H1c: Intention to mitigate wildfire risk will have a significant and positive relationship with actual wildfire mitigation behavior (Figure 4).

H1d: Perceived behavioral control will significantly moderate the relationship between intention to mitigate wildfire risk and actual wildfire mitigation behavior (Figure 4).

H2a: The belief factors of behavioral beliefs, normative beliefs, and control beliefs will have a significant and positive relationship with their associated factors of attitude toward wildfire mitigation, subjective norm, and perceived behavioral control (Figure 5).

H2b: Perceived wildfire risk, personal experience, subjective knowledge, locus of responsibility, attitude toward wildfire mitigation, subjective norms, and perceived behavioral control will each have a significant and positive relationship with intention to mitigate wildfire risk (Figure 5).

H2c: Intention to mitigate wildfire risk will have a significant and positive relationship with actual wildfire mitigation behavior (Figure 5).

H2d: Perceived behavioral control will significantly moderate the relationship between intention to mitigate wildfire risk and actual wildfire mitigation behavior (Figure 5).

H2e: Actual wildfire mitigation behavior will have a significant and negative relationship with perceived wildfire risk (Figure 5).

H2f: Personal experience will have a significant and positive relationship with subjective knowledge (Figure 5).

H3: Perceived wildfire risk will have a significant indirect effect on the relationships between the model factors of personal experience, subjective knowledge, locus of responsibility, attitude toward wildfire mitigation, subjective norm, and perceived behavioral control and intention to mitigate wildfire risk (Figure 6).

H4: Homeowner's mitigation behaviors in a neighborhood within an HOA will be significantly different than homeowners not in an HOA.

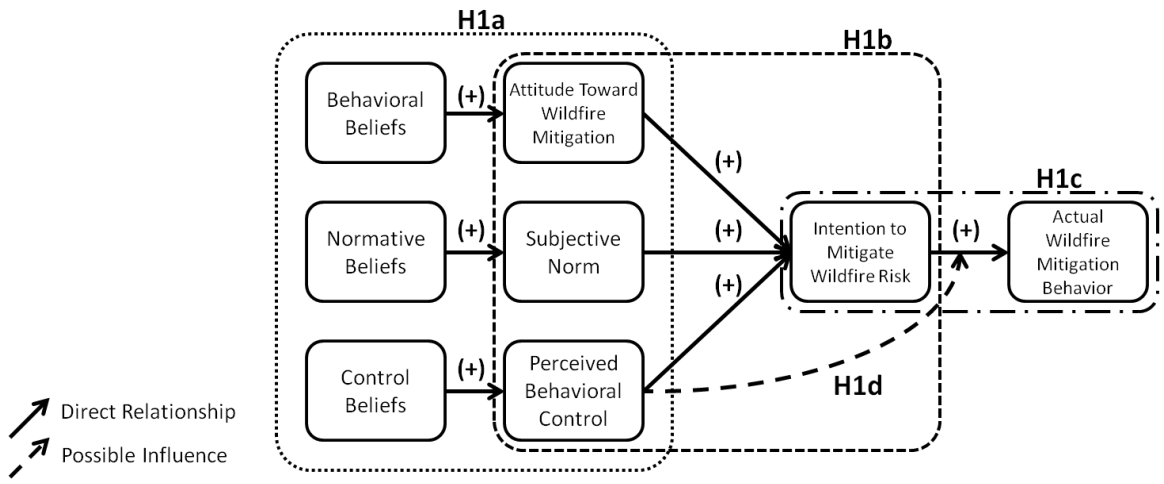


Figure 4. Test of TPB (H1)

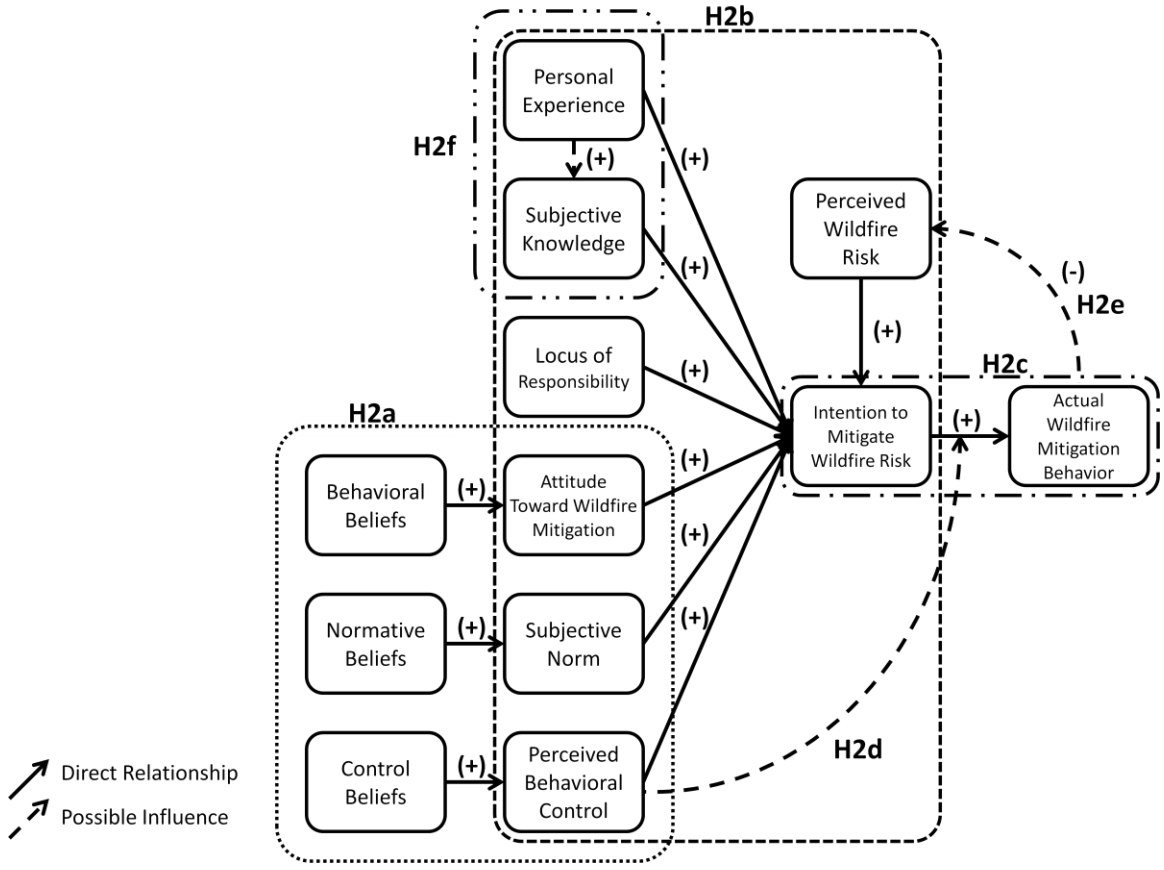


Figure 5. Test of WMB (H2)

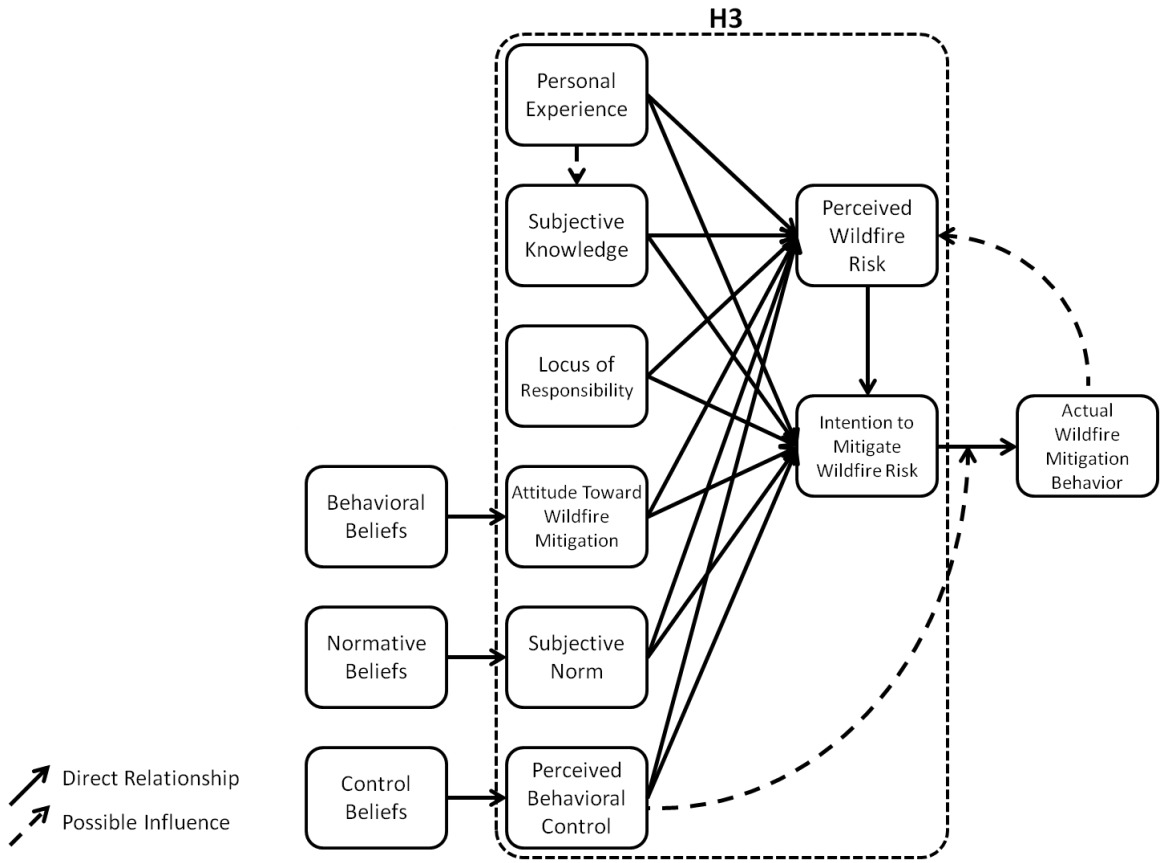


Figure 6. Test of WMB Perceived Wildfire Risk Mediation (H3)

METHODS

This study used a multi-method approach that included three stages to understand wildfire mitigation behaviors for homeowners living in the WUI in and around the City of Prescott, Arizona: 1). a series of interviews were conducted with neighborhood leaders to identify local dynamics, 2). a questionnaire was developed and tested through a pilot study administered to a small subset of the study population, and 3). the main study questionnaire was administered to a representative sample of the population. The pilot and main study implemented a self administered mail questionnaire with an online option.

Study Location and Population

The study population is identified as homeowners in the WUI, within the Prescott city boundaries and select unincorporated neighborhoods outside the city limits in Yavapai County, Arizona. The approximate population of Prescott is 41,000 people (United States Census Bureau, 2015). The population of Prescott is comprised of mainly white (87.1%) with 9% identifying as Hispanic or Latino (United States Census Bureau, 2015). The United States Census Bureau (2015) identifies 22,159 housing units with 66% being owner occupied which equates to about 14,500 units. In addition, median home values are $265,500 and rent values average $800 per month (United States Census Bureau, 2015).

Table 1

Prescott Census Demographics

	Prescott	Arizona
Population, 2014 estimates	40,958	6,731,484
Population change (2010 – 2014)	2.8%	5.3%
Gender (female)	50.8%	50.3%
Persons under 18 years of age (2010)	13.6%	25.5%
Persons 65 years of age and over (2010)	30.8%	13.8%
Race, White (not Hispanic)	87.1%	57.8%
Hispanic or Latino	8.6%	29.6%
High school graduate	91.7%	85.7%
Bachelor's degree or higher	35.4%	26.9%
Homeownership rate (2009-2013)	65.3%	64.4%
Housing units (2010)	22,159	2,844,526
Median value of housing units (2009-2013)	$263,100	$165,100
Median household income (2009-2013)	$44,224	$49,774

(United States Census Bureau, 2015)

The study region presents high wildfire risk because of the fuel characteristics, topography, and weather present. The vegetation in the region is largely dense stands of ponderosa pine, pinion juniper, scrub oak, and desert grasses (Arizona Cooperative Extention, 2015). These plant species are very susceptible to combustion, especially during the hot dry periods in late spring to early summer before the monsoon rains. Prescott has average summer high temperatures reaching close to 90° with lows around 60°. With the semi-arid climate and active spring and summer lightning storms which produce little precipitation, the area is at a high risk for vegetation ignition. The city is situated in the Bradshaw Mountains located in central Arizona at an elevation of 5,200 feet above sea level with surrounding peaks reaching over 8,000 feet (City of Prescott Office of Tourism, n.d.). With many canyons, valleys, cliffs, and steep mountain ridges, the area has terrain that can increase the intensity of wildfires, especially when factoring in the high unpredictable winds associated with the late spring and early summer storms.

The Prescott area was selected as an ideal location and population for this study because of these inherent risks and the associated opportunities for studying wildfire mitigation behaviors. The location provides the ability to examine such behaviors across differing community dynamics of neighborhoods, for instance, the presence or absence of HOA's or impacts of ordinances. One of the critical elements of site selection was the number of neighborhoods within the WUI. The city has around 50 neighborhoods with an active association and over 150 without an association all with sections or completely encompassed in the WUI. Unincorporated regions of Yavapai County were included in the population. These areas included neighborhoods west and north of the City of Prescott. These unincorporated areas were chosen due to their proximity to recent fires and to gain perspectives different than those in the city boundaries. The area is cradled by the Prescott National Forest along the southern and western boarders of the city with undeveloped state trust and county land along the northern border. There are 24 neighborhoods which are recognized as Firewise Communities through the NFPA program within the area. The region has experienced devastating wildfires in its past which has spurred many local neighborhoods to form PAWUIC, a nationally recognized organization, focused on promoting and educating the firewise ideal and connecting residence with national, state, county, and city officials. Overall, the city is identified as having a very high wildfire risk.

By partnering with PAWUIC for this study, access to officials and participating neighborhoods were gained. Though the members of PAWUIC do not represent every

neighborhood in Prescott, the connections made and information gained through PAWUIC were instrumental in connecting with local neighborhoods.

Study Development

For this study a mixed method approach was used. This approach combines qualitative and quantitative methods to strengthen the study (Creswell, 2009; Dillman et al., 2009). Singleton (2010) suggests the use of a multi-method approach in what is referred to as "triangulation" which offers a way to validate an answer or concept through independent approaches that minimize error by combining the strengths of each approach. Additionally, Fishbein and Ajzen (2010) identify a multi-method approach in developing a TPB study and its questionnaire. In developing a TPB study, attitudes, perceived norms, and perceived behavioral controls have a defined measurement structure (Fishbein & Ajzen, 2010). Development of the indirect belief measures requires a qualitative approach to identify the salient concepts specific to the population being studied. In order to identify relevant behavioral outcomes, normative referents, and control factors, a small convenient sample of the population was asked a series of directed open ended questions. This was done through semi-structured interviews. The responses to these interviews were analyzed through content analysis. The results informed the TPB questions used in the development of a self-administered questionnaire. Following Fishbein and Ajzen (2010) recommendations, a pilot study tested the validity and reliability of these developed items. The pilot study included the background factors so relevance of these can also be assessed. The main study implemented the questionnaire that utilized the identified valid and reliable items from

the pilot study (Fishbein & Ajzen, 2010). The details to this method are explained in the following section.

Interviews

To address the need for scale development and to gain an understanding of the community, interviews were conducted during the Fall of 2015 with neighborhood leaders. The following section reviews the rationale and sampling procedures for the interviews.

Interview Rational

Face to face interviews provide a platform to gain a deeper understanding and to elicit a broad range of concepts from the population of interest. In the context of this study, there were three rationales in conducting interviews with Prescott neighborhood community leaders. The first rationale was to learn about the community, specific neighborhoods, and their current needs and concerns as they pertain to wildfire mitigation. As a researcher not living in the Prescott area there was a need for a more intimate understanding of the community. In other words, it was important to gain a sense of the community dynamics before attempting to research its residents. The second rational was to identify some of the influences of city and county policies on the neighborhoods as well as the HOAs' role in homeowner wildfire mitigation. Rational three was to elicit responses to behavioral outcomes, normative referents, and control factors specific to the community. These responses were used to develop items for the questionnaire related to each belief factor to be measured (Fishbein & Ajzen, 2010).

Interview Instrumentation

Before conducting the interviews, the interview script was submitted for approval by the university's Institutional Review Board (IRB). The IRB approval ensured ethical recruitment strategies and treatment of participants, privacy, and anonymity. In addition the approval ensured a process for participant consent in the study. The study was approved for exempt status due to the exclusion of sensitive populations and guaranty of anonymity of participants (Appendix H).

This qualitative strategy of key informant interviews was selected due to its ability to gain unique insight that close ended questionnaires would not. Interviews also allowed the opportunity to probe certain areas of interest for deeper understanding into the community, its struggles and successes, and dynamics at play. This formative strategy of inquiry is a key element of the overall study in gaining, as stated earlier, an intimate understanding of the community.

The interview responses had a profound effect on the overall study in indentifying the key factors in play as related to TPB measures. Most notable were with the model background factors that are relevant to the community. The interview responses also identified detailed attributes, referents, and factors in developing TPB belief items.

Interview Script

The interview script (See Appendix C) was largely developed not only to gain knowledge of the local neighborhoods, but also to address underlining factors that are theorized to influence homeowner mitigation actions. Identified in the model's background factors, these measures address unique groups within the population. In

addition, a series of questions were developed based on the processes of eliciting local beliefs to wildfire mitigation behaviors as outlined by Fishbein and Ajzen (2010). The responses are used in developing valid belief items for TPB factors, specifically the behavioral outcomes, normative referents, and control factors.

To get a sense of employment in the neighborhoods and its impact on mitigation actions, a series of questions were asked concerning employment status of the residents. Participants were asked to "please describe the type of residents" in the neighborhood. In other words, "Are homeowners working a regular job (not retired) in the Prescott area, retired and residing permanently in the Prescott area, seasonally retired residents, etc? How does this influence the dynamics of the neighborhood? How does this influence wildfire mitigation actions on private property?"

Seasonality, residency, and their influence on mitigation were addressed through a series of questions asking participants to "describe the residency in the neighborhood, do homeowners tend to be longtime or new, seasonal or fulltime residents, or a combination? If a combination, what is the ratio? How does this influence the dynamics of the neighborhood? How does this influence wildfire mitigation on private property?"

To understand impact of municipalities and programs a set of questions were asked focusing on awareness, type of wildfire mitigation programs, and the penalties and rewards for mitigation compliance. Participants were asked if they "are … aware of state, county, city, or HOA regulations on firewise construction and parcel maintenance that affect this neighborhood? Are … aware of programs available? Are the

regulations/programs mandatory or voluntary? Are there penalties for non-compliance or incentives for compliance?" "Are the programs governmental?"

To gain insight on associations, a set of questions asked about association and resident support of wildfire mitigation actions. This was put in the context of Firewise Communities designation as participants were very familiar with the program and what it entailed (see Appendix B). Most participants interviewed had neighborhoods with some local association, either an HOA or non-profit organization, providing a semblance of a community organization with central neighborhood management. Participants were asked "how supportive is the neighborhood (HOA) of [firewise] designation?" and "how active is the HOA and/or residents in supporting actions in the neighborhood and on their private property?"

In developing the salient belief scales, Ajzen and Fishbein (1980) identify a process of asking open ended questions centered on behavioral outcomes, normative referents, and control factors. To elicit responses to behavioral outcomes, participants were asked "what do you see as the advantages of completing wildfire mitigation/firewise actions on your property and home?" and to understand the other end of the spectrum "What do you see as disadvantages of completing wildfire mitigation/firewise actions on your property and home?" To elicit responses concerning normative referents, two sets of questions were asked. The first set of questions were intended to address injunctive beliefs of referents by asking participants "please provide individuals (not by name , just association) or groups who would approve of or think you should mitigate your property and home from wildfire risk?" and conversely "please provide individuals (not by name,

just association) or groups who would disapprove or think you should not mitigate your property and home from wildfire risk?"; the second set of questions elicited descriptive beliefs of referents by asking participants "please list individuals (not by name, just association) or groups in and around you neighborhood who are most likely to perform mitigation actions to become firewise?" and "please list the individuals (not by name, just associations) or groups in and around your neighborhood who are least likely to perform mitigation actions to become firewise?" In eliciting responses to control factors, participants were asked two questions, "please list any factors or circumstances that would make it easy or enable you to complete mitigation actions on your property and home?" and conversely "please list any factors or circumstances that would make it difficult or prevent you from completing mitigation actions on your property and home?"

Interview Participants and Sampling Procedures

Potential participants were identified as neighborhood leaders or residents who are active in the neighborhood either in the HOA, Firewise Communities program, or as someone knowledgeable of the neighborhood dynamics and history. Participants were identified through a convenient sample of active members/neighborhoods in PAWUIC. Email and phone numbers were provided by PAWUIC and prospective participants were contacted and invited to participate in the study.

Initial contact was through an email to members, who were identified as the neighborhood representative within PAWUIC, asking questions about their neighborhood's size, location, and type of homes. From this information a range of neighborhoods were selected to represent different characteristics in and around Prescott,

Arizona. A total of eight interviews were conducted. The majority were in the participant's home with some at local coffee house establishments. The interviews lasted from 45 minutes to an hour and half. After the one-on-one interviews were completed, a short tour and assessment of the neighborhood was conducted, most of the time with the interview participant. The neighborhood tour provided an on the ground assessment of what was being described in the interview and a firsthand visual of the wildfire risk and mitigation work of the neighborhood residents. The interviews were stopped after a total of eight completed due to reaching data saturation.

Interview Analysis

The interview data were analyzed through a series of steps as outlined by Creswell (2009). The first step involved organizing the raw data from participant's open ended responses to the interview questions in a form that can be analyzed. For this study, the recorded interviews and notes were reviewed and comments were summarized for each participant with respect to the background factors of concern and belief questions. The summarized data were then reviewed to gain a general sense of the responses to each question. This step was intended to develop a familiarity with the data as the researcher prepares for the actual analysis. The next step involved developing thematic categories based on the participant responses. This process of coding qualitative data into themes requires interpretation of the data by the researcher. To minimize biases and provide validation, a second researcher not associated with the data collection independently summarized the data based on the same criteria. The coded themes of the two interviewers were compared for any differences. Discrepancies of coded themes were

deliberated between researchers and a common set of themes were agreed upon. The final step of this interview data analysis was interpreting the themes and their meaning in the context of the study to inform the development of a questionnaire.

Questionnaire

The study implemented a quantitative questionnaire based on theory, past literature, and themes gained from participant interviews. This section describes the questionnaire development, pilot study, processes for administering the questionnaire, and selection of participants.

Instrumentation

The questionnaire used for this study was specifically developed to address each research question. Many of the questions used in the questionnaire are adopted or adapted from literature. Major sections of the questionnaire included a cover letter and instructions to orientate the respondent. The first section focused on questions related to residence, including parcel and house characteristics, and HOAs; the second section was centered on household mitigation and included questions related to intention to mitigate wildfire risk, actual wildfire risk measures, perceived risk, and locus of responsibility questions; the personal relevance section had questions on personal experience and subjective knowledge; the attitudes, norms, and controls section included questions asking about attitude toward wildfire mitigation, behavioral beliefs, subjective norms, normative beliefs, perceived control, and control beliefs; and the final section focused on demographics included education, age, gender, income, race/ethnicity, and employment of respondents. The questions included two types of scales: Likert type (subjective

knowledge, locus of responsibility, and perceived risk) and semantic differential unipolar and bipolar adjective pair (attitude toward wildfire mitigation, subjective norms, perceived control, and belief items).

The following sections outline the development of each factor's set of item measures that were used in the questionnaire. The TPB factors and associated items will be presented first followed by salient mitigation factors and then the background factors.

Indirect TPB Measures

For this study, the measures that were developed in addressing TPB were adapted from Fishbein and Ajzen (2010) in which an outlined process of developing a TPB questionnaire is defined. The initial step in the process is to define the four elements of behavior which are action, target, context, and time. Action in this study is defined as wildfire mitigation behaviors of homeowners; the target is the vegetation and home; the context is the homeowner's property; while the time is within a year or 12 months.

Fishbein and Ajzen (1975) identify a set of indirect belief measures for attitudes, perceived norms, and perceived behavioral control. Salient beliefs, often already formed by the individual through life experience, provide good indicators of the direct measures in TPB. As described earlier, these measures were developed by asking interviewees a series of questions to elicit responses relating to each element of beliefs. These responses were analyzed and the salient belief responses were identified and incorporated into the belief measures. The TPB scales used are suggested by Fishbein and Ajzen (2010) and provide the appropriate measurement for calculating the composite measures.

Behavioral Beliefs

Behavioral beliefs provide an indirect measure of attitudes and follows the expectancy-value model in attitude formation as outlined by Fishbein's (1963) summation theory. It is assumed that people have beliefs that are previously formed about the behavior. In the formation of these beliefs, it is theorized that prior evaluations of the behavior are connected to the likelihood of the behaviors outcome culminating in the person's overall attitude (Fishbein & Ajzen, 2010). For example, a person may have an overall poor attitude towards consuming alcohol. One with this attitude might evaluate getting drunk as bad and the outcome of getting intoxicated off of one beer as likely. This creates a strong negative belief of alcohol consumption. It is suggested that as a person's beliefs become stronger the more influence it will have on their attitude toward the behavior (Fishbein & Ajzen, 2010). This is represented by Equation 1 and shows how attitudes (A) are formed by the summation of belief (b) strength that the behavior has attribute i multiplied by the evaluation (e) of attribute i .

$$A \propto \sum b_i e_i \tag{1}$$

Behavioral belief strength is defined as the strength that the behavioral belief object will occur and the outcome evaluation is defined as the positive or negative evaluation of the belief object (Fishbein & Ajzen, 2010). A series of nine behavioral belief strength semantic differential scales were developed with associated outcome evaluation measures. The belief measures ask questions concerning wildfire risk reduction actions in context of security, family safety, protection of property value, privacy, cost, risk reduction, protection of personal property, property appearance, and

effectiveness. These measures were calculated according to Equation 1 for a single measure of behavioral beliefs. Each behavioral belief strength item will be measured on a seven point scale with 1 = *unlikely* and 7 = *likely*. Outcome evaluations will be measured on a seven point bipolar scale with -3 = *bad* and 3 = *good.*

Behavioral Belief Strength

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will give me a sense of security."

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will provide safety for my family."

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will protect my property value."

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will still provide privacy around my house."

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will come at a significant cost."

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will reduce my risk to wildfire's impacts."

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will protect my personal belongings."

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will improve property appearance."

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will not stop a fire from burning down my home."

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

Outcome Evaluations

"A sense of security is"

bad : -3 : -2 : -1 : 0 : +1 : +2 : +3 : good

"Protecting my family is"

bad : -3 : -2 : -1 : 0 : +1 : +2 : +3 : good

"Protection of my property value is"

bad : -3 : -2 : -1 : 0 : +1 : +2 : +3 : good

"Privacy around my house is"

bad : -3 : -2 : -1 : 0 : +1 : +2 : +3 : good

"Significant costs for mitigation my"

bad : -3 : -2 : -1 : 0 : +1 : +2 : +3 : good

"Reducing my risk to wildfire's impact is"

bad : -3 : -2 : -1 : 0 : +1 : +2 : +3 : good

"Protection of my belongings is"

bad : -3 : -2 : -1 : 0 : +1 : +2 : +3 : good

"Improving my property's appearance is"

bad : -3 : -2 : -1 : 0 : +1 : +2 : +3 : good

"My home burning down is"

bad : -3 : -2 : -1 : 0 : +1 : +2 : +3 : good

Normative Beliefs

Normative beliefs seek to measure, indirectly, perceived norms. Fishbein and Ajzen (2010) identify two sets of beliefs that should be measured for a complete measurement of normative beliefs. These are injunctive beliefs and descriptive beliefs. Injunctive beliefs seek to address the beliefs held by an individual that important referents think they should or should not complete the studied behavior. Injunctive beliefs are paired with measures of motivation to comply which address the individuals desire comply with what they believe the referent desires them to do. Descriptive beliefs seek to measure an individual's belief of referent's actions and are addressed through a set of two measures, descriptive belief strength and identification with referent. Descriptive belief strength assesses the belief of behaviors that referents are performing while identification with referent addresses the desire to be like the referent.

Just as with behavioral beliefs, normative beliefs utilize a similar formulation. Each set of beliefs, injunctive and descriptive, are calculated based on the following equations. Equation 2 represents the formula for calculating injunctive Belief (*IB*) by the summation of the product of injunctive normative beliefs (*n*) about referent i and motivation to comply (*m*) with referent i. Injunctive belief (*IB*) is then divided by total number of referents. Likewise, descriptive belief (*DB*) is calculated by the summation of descriptive belief strengths (*d*) of referent i multiplied by identification with referent *i* (*r*) (equation 3). As with injunctive belief, descriptive belief (*DB*) is divided by total number of referents.

$$IB \propto \sum n_i m_i \quad (2)$$

$$DB \propto \sum d_i r_i \quad (3)$$

The referents identified in the interviews related to neighbors, friends, family, homeowners associations, and the city of Prescott and Yavapai County, Arizona. The normative belief scales as suggested by Fishbein and Ajzen (2010) are measured on a set of seven point bipolar scales with injunctive norms measured from -3 = *should not* to +3 = *should* with motivation to comply measured on a 1 = *disagree* to 7 = *agree* scale. Descriptive belief strength items are measured from -3 = *would not take action* to +3 = *would take action,* and identification with referent from 1 = *not at all* to 7 = *very much*. These measures will be calculated as stated above with equations 2 and 3. The index measure of normative beliefs will provide an overall measure of individual's perception with respect to social pressures by referents. Negative values will show beliefs of little influence of referents performing mitigation behaviors or influence by referents who are promoting non-mitigation behaviors while positive values will show beliefs of positive influence by referents performing mitigation behaviors or little influence by referents who do not promote mitigation actions.

Injunctive Normative Beliefs

"My neighbors think that I ____ perform wildfire risk reduction actions on my property's vegetation and home in the next 12 months."

should not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : should

"My friends think that I ____ perform wildfire risk reduction actions on my property's vegetation and home in the next 12 months."

should not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : should

My family think that I ____ perform wildfire risk reduction actions on my property's vegetation and home in the next 12 months."

should not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : should

"My homeowner association thinks that I ____ perform wildfire risk reduction actions on my property's vegetation and home in the next 12 months."

should not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : should

"The city of Prescott and/or Yavapai County thinks that I ____ perform wildfire risk reduction actions on my property's vegetation and home in the next 12 months."

should not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : should

Motivation to Comply

"When it comes to reducing my risk from wildfires, I want to do what my neighbor thinks I should do."

disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree

"When it comes to reducing my risk from wildfires, I want to do what my friends think I should do."

disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree

"When it comes to reducing my risk from wildfires, I want to do what my famiy think I should do."

disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree

"When it comes to reducing my risk from wildfires, I want to do what my homeowner association thinks I should do."

disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree

"When it comes to reducing my risk from wildfires, I want to do what the city of Prescott and/or Yavapai County thinks I should do."

disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree

Descriptive Belief Strength

"My neighbors ____ perform wildfire risk reduction actions on their property's vegetation and home in the next 12 months."

would not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : would

"My friends ____ perform wildfire risk reduction actions on their property's vegetation and home in the next 12 months."

would not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : would

"My family ____ perform wildfire risk reduction actions on their property's vegetation and home in the next 12 months."

would not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : would

"Owners of undeveloped property ____ perform wildfire risk reduction actions on their property's vegetation and home in the next 12 months."

would not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : would

"Full-time residents ____ perform wildfire risk reduction actions on their property's vegetation and home in the next 12 months."

would not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : would

"Renters ____ perform wildfire risk reduction actions on their property's vegetation and home in the next 12 months."

would not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : would

"Out of state property owners ____ perform wildfire risk reduction actions on their property's vegetation and home in the next 12 months."

would not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : would

"Seasonal/part-time residents ____ perform wildfire risk reduction actions on their property's vegetation and home in the next 12 months."

would not : -3 : -2 : -1 : 0 : +1 : +2 : +3 : would

Identification with Referent

"When it comes to matters of reducing risks from wildfires, how much do you want to be like your neighbors?"

not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : very much

"When it comes to matters of reducing risks from wildfires, how much do you want to be like your friends?"

not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : very much

"When it comes to matters of reducing risks from wildfires, how much do you want to be like your family?"

not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : very much

"When it comes to matters of reducing risks from wildfires, how much do you want to be like owners of undeveloped property?"

not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : very much

"When it comes to matters of reducing risks from wildfires, how much do you want to be like full-time residents?"

not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : very much

"When it comes to matters of reducing risks from wildfires, how much do you want to be like renters?"

not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : very much

"When it comes to matters of reducing risks from wildfires, how much do you want to be like out of state property owners?"

not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : very much

"When it comes to matters of reducing risks from wildfires, how much do you want to be like seasonal/pat-time residents?"

not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : very much

Control Beliefs

Control beliefs seek to assess an individual's perceived opportunities and impediments to completing the behavior in question (Fishbein & Ajzen, 2010). Eliciting control beliefs is assessed by individual's perceptions of the power of control factors and strength of those factors to facilitate or impede performance of the behavior in question (Fishbein & Ajzen, 2010).

Control belief is calculated similarly as behavioral and normative beliefs and is represented by equation 4. Control Belief (*CB*) is theorized to be assessed by the summation of control belief strength (*c*) of factor *i* multiplied by the power of control (*p*) of factor *i*. Control belief strength items are measured on a seven point unipolar scale with 1 = *unlikely* to 7 = *likely*. Power of control factor items are measured on a seven point bipolar scale with -3 = *disagree* to +3 = *agree*. Control beliefs will be calculated based on equation 4 then divided by the total number of factors. This will provide an indirect measure of perceived behavioral control with negative measures identifying beliefs of impeding factors while positive measure identify beliefs of facilitating factors.

$$CB \propto \sum c_i p_i \tag{4}$$

Power of Control Factor

"Being physical fit would enable me to perform wildfire risk reduction actions on my property's vegetation and home in the next 12 months."

disagree : -3 : -2 : -1 : 0 : +1 : +2 : +3 : agree

"A debilitating illness would make it difficult for me to perform wildfire risk reduction actions on my property's vegetation and home in the next 12 months."

disagree : -3 : -2 : -1 : 0 : +1 : +2 : +3 : agree

“Living on a fixed income would make it difficult for me to perform wildfire risk reduction actions on my property’s vegetation and home in the next 12 months.”

disagree : -3 : -2 : -1 : 0 : +1 : +2 : +3 : agree

“Having the knowledge on how to protect my property would enable me to perform wildfire risk reduction actions on my property’s vegetation and home in the next 12 months.”

disagree : -3 : -2 : -1 : 0 : +1 : +2 : +3 : agree

“Daily obligations such as family and work make it difficult to find time to perform wildfire risk reduction actions on my property’s vegetation and home in the next 12 months.”

disagree : -3 : -2 : -1 : 0 : +1 : +2 : +3 : agree

“Having the tools to mitigate would enable me to perform wildfire risk reduction actions on my property’s vegetation and home in the next 12 months.”

disagree : -3 : -2 : -1 : 0 : +1 : +2 : +3 : agree

Control Belief Strength

“I will be physically fit in the next 12 months”

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

“I will experience a debilitating illness in the next 12 months”

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

“I will be on a fixed income in the next 12 months”

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

“I will have the knowledge on how to mitigate in the next 12 months”

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

“I will not have the time to perform risk reduction actions in the next 12 months”

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

"I will have the tools needed to mitigate in the next 12 months"

unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely

Direct TPB Measures

For direct measures of attitude toward wildfire mitigation, subjective norms, and perceived behavioral control, a set of semantic differential scales are suggested and constructed to be consistent with the four behavioral elements. The following will describe each of the model's direct factor measures and their scale development for this study.

Attitude Toward Mitigation Behavior

Fishbein and Ajzen (2010) define attitude as "a latent disposition or tendency to respond with some degree of favorableness or unfavorableness to a psychological object" (p. 76). To address attitudes, as with most TPB direct measures, seven point semantic differential scales of adjective pairs are used to assess evaluative disposition. Because certain adjective pairs can measure factors other than evaluative disposition, a factor analysis was performed to confirm that the adjective pairs are measuring evaluative disposition of mitigation behaviors (Fishbein & Ajzen, 2010). This was done with data collected through the pilot study and only relevant adjective pairs were retained for the final study. Fishbein and Ajzen (2010) identify that each population is different and using items used in past research may not necessarily measure the same thing in a new population. In addition, with the potential of removing sets of adjective pairs that are not measuring evaluative disposition, it is suggested that the research starts with a large list. Below are the question and adjective pair semantic differentials that were used in the Main study. The items in the main study were tested for internal consistency and

averaged for a single measure of attitude toward wildfire mitigation with high values identifying an overall good attitude toward mitigation behaviors and low values a poor attitude toward mitigation behaviors.

"Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months is:"

harmful	: 1 : 2 : 3 : 4 : 5 : 6 : 7 :	beneficial
bad	: 1 : 2 : 3 : 4 : 5 : 6 : 7 :	good
worthless	: 1 : 2 : 3 : 4 : 5 : 6 : 7 :	valuable
foolish	: 1 : 2 : 3 : 4 : 5 : 6 : 7 :	wise
useless	: 1 : 2 : 3 : 4 : 5 : 6 : 7 :	useful
punishing	: 1 : 2 : 3 : 4 : 5 : 6 : 7 :	rewarding
unenjoyable	: 1 : 2 : 3 : 4 : 5 : 6 : 7 :	enjoyable
undesirable	: 1 : 2 : 3 : 4 : 5 : 6 : 7 :	desirable
unimportant	: 1 : 2 : 3 : 4 : 5 : 6 : 7 :	important

Subjective Norms

In the understanding of intentions and behaviors, the influence of others can play an important role. Fishbein and Ajzen (2010) define subjective norm as "an individual's perception that most people who are important to him/her think that he/she should (or should not) perform a particular behavior" (p. 131). To gain a full understanding of norms influencing an individual, TPB seeks to measure two dynamics. One dynamic tests how individuals are influenced by their perceptions of what others important to them think they should or should not do. This is defined as injunctive norms. The other dynamic tests how individuals are influenced by their perception that others are or are not performing the behavior. This is defined as descriptive norms. Measure for each are

outlined below. Each item is measured on a seven point semantic differential scale. The injunctive and descriptive items were analyzed together to identify internal consistency and averaged to create a single measure of subjective norms with high values identifying a strong perception that others think the individual should perform mitigation behaviors and low values signifying that an individual's perception is that others think they should not perform mitigation behaviors.

Injunctive

"Most people who are important to me think that ___ perform wildfire risk reduction actions on my property's vegetation and home."

I should not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : I should

"Most people whose opinion I value would approve of my performing wildfire risk reductions activities on my property's vegetation and home."

Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Strongly agree

Descriptive

"It is expected of me that I complete wildfire risk reduction actions on my property's vegetation and home every year."

definitely false : 1 : 2 : 3 : 4 : 5 : 6 : 7 : definitely true

"Most of the residents in my neighborhood with whom I am acquainted with have preformed risk reduction activities on their property's vegetation and home to minimize the threat of wildfire."

definitely false : 1 : 2 : 3 : 4 : 5 : 6 : 7 : definitely true

Perceived Behavior Control

Defined as "the extent to which people believe that they are capable of performing a given behavior, that they have control over its performance", perceived behavioral control provides an important aspect to TPB (Fishbein & Ajzen, 2010, pp.

155). With positive attitudes of the behavior and pressure by important referents, people may still not perform the behavior if they perceive themselves incapable, due to lack of knowledge, skills, opportunities, or resources. To understand perceived behavioral control deeper, Fishbein and Ajzen (2010) identify two aspects revolving around an individual's capacity to complete the behavior and an individual's autonomy in completing the behavior.

To measure perceived behavioral control, the same question elements as previously described are used. The items are measured on a seven point semantic differential scale. Perceived behavioral control has two categories, capacity and autonomy, which were analyzed together to identify the items internal consistency. The items were averaged to create a single measure of perceived behavioral control with high values identifying a strong perception that the individual has the knowledge, skills, and/or ability to perform mitigation behaviors and low values signifying that an individual is lacking the knowledge, skills, and/or ability to perform mitigation behaviors.

Capacity

"For myself to complete wildfire risk reduction actions on my property's vegetation and home in the next 12 months is:"

extremely difficult: 1 : 2 : 3 : 4 : 5 : 6 : 7 : extremely easy

"I am confident that if I wanted to I could complete wildfire risk reduction actions on my property's vegetation and home in the next 12 months."

definitely false : 1 : 2 : 3 : 4 : 5 : 6 : 7 : definitely true

"For me to complete wildfire risk reduction actions on my property's vegetation and home in the next 12 months is:"

impossible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : possible

Autonomy

"I feel in complete control over whether I perform wildfire risk reduction actions on my property's vegetation and home in the next 12 months."

Completely false : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely true

"The number of events outside my control which could prevent me from performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months are:"

Numerous : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very few

Wildfire Mitigation Behaviors

Wildfire mitigation behavior is the overt actions taken by a homeowner to reduce their risk from wildfires that may negatively impact life and property before such events occur (Brenkert-Smith et al., 2012; Champ et al., 2013; Faulkner et al., 2009; Martin et al., 2009; McNeill et al., 2013; Nelson, Monroe, Johnson, & Bowers, 2004; Vogt et al., 2011). Wildfire mitigation has been measured a few different ways with most research providing a series of mitigation items and having the participants identify which ones where completed in a dichotomous "yes," "no" question (Brenkert-Smith et al., 2012; Champ et al., 2013; Martin et al., 2009; McNeill et al., 2013; Nelson et al., 2004). These items are then summed to provide a measure of mitigation actions taken. Other studies have used an ordinal range for each item with options such as "completed," (Faulkner et al., 2009; I. M. Martin et al., 2007) and "not a feature of my home or property," action already taken when purchased," "took action for other reasons," "took action for wildfire safety," "have not done this action" (Vogt et al., 2011). Some studies have segmented the different types of mitigation actions into categories such as "vegetated fuel-reduction actions," "structural actions," and "other actions" (Brenkert-Smith et al., 2012) and

"defense items," "evacuation items," "resilience items," and "planning items" (McNeill et al., 2013).

For this study, a number of the previous measurement tools were adapted. Because of the nature of different mitigation action as identified by Brenkert-Smith et al. (2012), this study categorized a set of mitigation action into two categories of maintenance and construction (structure/design). This is to separate the regular maintenance actions from the one time capital improvement actions. The TPB is assessing behavior, so it is imperative to understand if the homeowner completed the actions or if the actions were completed by a previous owner. Therefore, the study also adapted the measurement scale from Vogt et al. (2011) to identify action taken by the homeowner. In addition, Vogt et al. independently measured if the mitigation item was a feature of the property. Understanding this is important in the overall measure of actual wildfire mitigation behaviors. The specific set of items were adopted from the NFPA's Firewise Program as described below.

The TPB is a process of predicting intention, conducting interventions, and measuring actual behavior. This prospective approach is how TPB is typically used. However, there has been research looking at prospective vs. retrospective measurement of behaviors in this context (Conner et al., 1999; Sheeran & Orbell, 2000). Fishbein and Ajzen (2010) present that many researchers do assess intention and past or current behavior at the same time leading to more retrospective studies. These studies have also shown that past behaviors often correlate with intentions better than prospective measures in part because intentions are influenced by an individual's past behavior. Studies

examining prospective verses retrospective measures of behavior have found little difference or advantages of either (Fishbein & Ajzen, 2010). Therefore, wildfire mitigation behaviors will be retrospectively measured for this study.

To measure actual wildfire mitigation behaviors, participants were asked to identify if each mitigation action is either "not a feature of my home or property," "action is not necessary, as it existed when home was purchased," "My household took this action primarily for wildfire safety reasons," "my household took this action primarily for other reasons," and "Did not take action." The mitigation items will be categorized as maintenance and construction (structure/design) actions. The wildfire mitigation maintenance items will include "roof and rain gutters are kept free of leaves, needles, and twigs," "overhanging and dead branches are removed within 10 feet of roof," "Firewood and lumber are stacked at least 30 feet away from all structures," "a green vegetated area is maintained at least 30 feet around the house," "trees and shrubs are thinned out within 30-50 feet from the house," "Shrubs and lower tree branches that could carry flames from the ground into the crown of the tree are removed," and "dead vegetation, leaves, and needles are cleared at least 30 feet from the house." The construction items will include "house has a fire-resistant roof (e.g. asphalt or metal)," "house has screening installed on all vents," "house construction materials (e.g. siding, porches, and decks) are fire-resistant," "underside of deck is enclosed to keep debris from collecting underneath," and "yard is landscaped with fire-resistant vegetation."

To calculate a measure of actual wildfire mitigation behaviors, the measure of "not a feature of my home or property" was coded as 1 = *a feature* and 0 = *not a feature*.

These responses were summed for each maintenance and construction factors to provide a measure of total features on the participant's property. Similarly, the measure of "my household took this action primarily for wildfire safety reasons" was coded as 1 = *took action* and 0 = *did not take action*. These responses were summed for a measure of total wildfire mitigation actions completed. Total wildfire mitigation actions completed were then divided by total features to provide a percent measure of actual wildfire mitigation behavior adjusted for actual features present.

Intention to Mitigate Wildfire Risk

Fishbein and Ajzen (2010) identify behavioral intentions as "indications of a person's readiness to perform a behavior" and is a key factor in predicting actual behaviors. In performing behavior it is a disposition toward that behavior which will motivate someone toward action which has been linked to the notion of intentions (Ajzen & Fishbein, 2005; Fishbein & Ajzen, 1975).

Most wildfire mitigation studies have not assessed intentions to mitigate, instead focusing on what factors directly predict actual behaviors. The few studies that have measured intentions in relation to mitigation behaviors have done so from a more general approach (Bates et al., 2009) with questions asking participants "protecting my home against wildfires is something I intend to do during the next six months," while Faulkner et al. (2009) identify a series of specific actions outlined in Partners in Protection (2003) '*FireSmart: Protecting your Community from Wildfire*' publication. This provided fifteen specific actions that were categorized as "easily completed activities," "defensible space," and "fire resistant home."

When addressing intentions it is important to maintain compatibility between the intention and actual behavioral measures (Fishbein & Ajzen, 2010). To avoid behavioral incompatibility, the elements defining the behavior and measures on intentions should be the same. Fishbein and Ajzen (2010) note that the use of different scales to measure intentions and behaviors can lower observed correlations. Thus intentions and behaviors should be measured in a similar fashion. In addition, measures should provide a comparable level of specificity. Measures of intention need to align with the same categories as behaviors. To gain this degree of compatibility, intentions were assessed in the same format as actual behaviors.

To measure intentions to mitigate wildfire risk, participants were asked to identify which category best explains their future intentions for each mitigation action. The categories were "not a feature of my home or property," "structural action is not necessary, as it was already completed," "my household plans to take this action within the next 12 months for wildfire safety reasons," "my household plans to take this action within the next 12 months primarily for other reasons," "my household does not plan to complete this action within the next 12 months." The same mitigation actions were used and categorized as maintenance and construction (see actual wildfire mitigation behaviors for items).

To calculate a measure of intentions to mitigate wildfire risk, the measure of "not a feature of my home or property" was coded as 1 = *a feature* and 0 = *not a feature*. These responses were summed for each maintenance and structure/design factors to provide a measure of total features on the participants property. Similarly, the measure of

"my household plans to take this action within the next 12 months for wildfire safety reasons" was coded as 1 = *intend to take action for wildfire safety* and 0 = *do not intend to take action for wildfire safety*. These responses were also summed for a measure of total intentions to reduce wildfire risk. Total intentions were divided by total features to provide a percent measure of intention to mitigate wildfire risk adjusted for actual features present.

Direct Mitigation Item Measures

Direct mitigation measures are items developed to address the major factors in the extended WMB. The following section describes these factors and their development for use in the model. Many factor items are adopted or adapted from previous literature. The direct mitigation measures include the factors of personal experiences, subjective knowledge, locus of responsibility, and perceived wildfire risk. Item and scale development are discussed for each factor.

Personal Experience

Personal experience signifies firsthand experience of wildland fire events where the homeowner has had either proximal (fire at a distance to create concern or force evacuation) or direct impact (fire that caused damage to property or loss of property or life). Personal experience has been assessed by asking participants if they had "ever evacuated or prepared to evacuate" and if they had experienced a "wildfire within 10 miles of [their] property" (Brenkert-Smith et al., 2012; Champ & Brenkert-Smith, 2016; Dickinson, Brenkert-Smith, Champ, & Flores, 2015). This measurement provides a basic understanding of the participants experience with wildfire but is very limited in all the

impacts that could influence behavior. In a study by Martin et al. (2009) the authors used a scale based on severity and asked participants "what type of experience have you had with catastrophic wildfire?" Including a level of severity is an important aspect as a proximal wildfire verse a direct experience will not have the same impact on behaviors as identified by Martin et al. (2009). The options, start from low severity (1) and progress to high (6), and include "heard about wildfire experience from neighbors, family, and/or friends," "fires occurred more than 50 miles from the property," "fires occurred 5 – 50 miles from the property," "fires occurred less than 5 miles from property," "evacuated from home," and "house, structure, and/or property destroyed." Martin and colleagues developed index measurement with severity of experiences. This measure was not a significant predictor. This inconsistency of experience's relationship with mitigation behaviors presents a need for continued development of the measure. Looking beyond typical measurements of experience in the literature, McCaffrey et al. (2011) in an empirical study found time spent in a fire prone area was an important element of experience suggesting the longer one has experience living in the WUI, the more likely one is to mitigate.

To create a more robust measure of experience, this study developed a wildfire experience index by adapting measures in the literature on experience use history (EUH) as well as mitigation. The EUH index has been used in measuring experience of many recreational setting (Budruk, Wilhem Stanis, Schneider, & Heisey, 2008; Hammitt, Backlund, & Bixler, 2004; Hammitt, McDonald, & Patterson, 1990; Kline, 2014; Petrick, 2002; White, 2008). Implementing EUH as a different way of measuring wildfire

experience can provide better insight to the dynamics of its relationship with wildfire mitigation behaviors. Based on Martin et al. (2009) level of experience severity, this study asked respondents "To understand impacts of wildfire events, please identify the year of your first and most recent experience with each of the following wildfire event. Also, provide the number of times you have experienced each." The events in order of low (1) to high (7) severity were "wildfire between 20 to 50 miles from property," "Wildfire between 10 to 20 miles from property," "wildfire within 10 miles of property," "prepared to evacuate property," "evacuated property," "house, structure, and/or property damaged," "house, structure, and/or property destroyed." Respondents provided the year first experienced, the most recent year experienced, and total number of times experienced, including the first and most recent. Though EUH measures experiences at the location in question and experience elsewhere to create categories of "beginner," "visitor," "local," and "veteran" (Hammitt et al., 1990), this study addressed a general measure of EUH combining all experience of wildfire events at current and past locations. This is due to the limited nature of such events occurring.

To calculate the wildfire experience measure, EUH was modified to include an event severity level as represented in equation 5. For the experience (*Exp.*), each event was calculated by multiplying the total number of experiences (*NE*) for event *i* by event *i* severity (*S*), then taking the product and adding it to total years of experience (*Y*) for event *i*. An index was calculated by summing the seven events and dividing by the record with the highest experience (*HE*). This created a measure of personal experience from 0 to 1.

$$Exp = \left[\sum Y_i + \left(NE_i * S_i\right)\right] / HE \quad (5)$$

Subjective Knowledge

The knowledge a person gains concerning wildland fire through social actions with homeowners, formal education events, personal curiosity, etc, is referred to as subjective knowledge (Bates et al., 2009; Brenkert-Smith et al., 2012; Kent et al., 2003; Martin et al., 2009). In the wildfire mitigation literature there are many studies that have measured subjective knowledge. Bates et al. (2009) assessed wildfire mitigation knowledge by asking a series of 14 true and false questions relating to different aspects of wildfire and mitigation. Brenkert-Smith et al. (2012) measured wildfire information sources and social interactions through five items with a "yes" or "no" response. The items were "neighbors, friends, or family members," "Local fire department," "County wildfire specialist," "media," and "talk about fire." Each was measured individually in a regression model. Faulkner et al. (2009), identified knowledge as a factor that helped to address awareness. To measure knowledge, a set of six true false statements were used and summed for a knowledge level. I. M. Martin et al. (2007) and Martin et al. (2009) assessed subjective knowledge by asking participants a series of three questions. Measured on a seven point scale with 1 = *not at all informed/not at all relevant/not at all motivated* to 7 = *very informed/very relevant/very motivated*, the questions asked "how well informed do you consider yourself to be about wildfire risk," "to what extent do you find information about wildfires to be personally relevant", and "how motivated are you to learn more about the connection between wildfire risk and undertaking behaviors to

create defensible space." The Cronbach's Alphas were $\alpha = 0.69$ and $\alpha = 0.84$ for the studies, respectively. A composite measure was created from the items.

This study adopted the Martin et al. (2009) measures for subjective knowledge due to the ability of assessing the respondent's level of wildfire knowledge. A set of three questions, "how well informed do you consider yourself to be about wildfire risk," "to what extent do you find information about wildfires to be personally relevant," and "how motivated are you to learn more about the connection between wildfire risk and undertaking behaviors to create defensible space" were used. The items were measured on a seven point scale with 1 = *not at all informed/not at all relevant/not at all motivated* to 7 = *very informed/very relevant/very motivated*. As in the Martin et al. (2009) study, a composite measure was calculated for a single variable of subjective knowledge.

How well informed do you consider yourself to be about wildfire risks?

Not at all informed : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very informed

To what extent do you find information about wildfires to be personally relevant?

Not at all relevant : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very relevant

How motivated are you to learn more about the connection between wildfire risk and undertaking behaviors to create defensible space around your home?

Not at all motivated : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very motivated

Locus of Responsibility

Locus of responsibility is defined as a homeowner's perception of who is responsible for mitigation actions on their property. Kent et al. (2003) measured responsibility by asking participants "how responsible should the following be for protecting their property" with option of homeowners, your homeowners association, and

the USDA Forest Service. These were measured on a seven point scale with 1 = "not at all responsible" to 7 = "very responsible." Faulkner et al. (2009) asked participants, "responsibility for reducing wildfire risk to one's house and property well before a wildfire occurs [is the responsibility of]," with five entities including "self and household members," "local fire department," "municipal government," "provincial government," and "federal government." Each of the entities were assessed with a 5 point scale with 1 = *strongly disagree* to 5 = *strongly agree*. Martin et al. (2009) measured locus of responsibility through a series of two questions of "how responsible should you be for protecting yourself from the impacts of wildfire" and "how responsible should you be for protecting your property from the impacts of wildfire". Each was measured on a seven point scale with 1 = *not at all responsible* to 7 = *very responsible*. The two items had a correlation of r = 0.88 and a composite measure was calculated to create the measure locus of responsibility. Measuring who is responsible for mitigation actions on a homeowner's property, as defined in Martin et al., does not fully addressed perception of who is responsible as outlined by the other studies.

This study adapted measures from Kent et al. (2003) and Faulkner et al. (2009). Locus of responsibility was measured by asking, "for protection of my property and home in Prescott, how responsible are each of the following in reducing wildfire risk" and "for overall protection of the Prescott community, how responsible are each of the following in reducing wildfire risk on land they manage." Six items will be listed for each question, "homeowner," "neighbors," "homeowners association," "City of Prescott," "County of Yavapai," "State of Arizona," "Bureau of Land Management," and

"USDA Forest Service," which were assessed on a seven point scale with 1 = *not at all responsible* to 7 = *very responsible*. Each item allowed for a "not applicable" response as some responses may not be relevant to all respondents. Items for each question were assessed for internal consistency and a composite measure calculated.

For protection of <u>your property and home</u> in Prescott, Arizona, how responsible are each of the following in reducing wildfire risk?

My self

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

My neighbors

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

Homeowner association

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

City of Prescott

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

County of Yavapai

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

State of Arizona

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

Bureau of Land Management

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

USDA Forest Service

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

For overall protection of the Prescott, Arizona community, how responsible are each of the following in reducing wildfire risk on lands they manage?

My self

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

My neighbors

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

Homeowner association

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

City of Prescott

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

County of Yavapai

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

State of Arizona

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

Bureau of Land Management

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

USDA Forest Service

Not at all responsible : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very responsible

Perceived Wildfire Risk

Perceived wildfire risk is defined as a homeowner's perception of the likelihood that a wildland fire will impact property and life and its level of severity (Kent et al., 2003; I. M. Martin et al., 2007; Martin et al., 2009). Kent et al. (2003) measured wildfire risk in three contexts of perceived vulnerability, risk perception, and perceived severity.

Perceived vulnerability measured "level of concerns about the effects of wildfire," "seriousness of the consequences of wildfire," "degree of physical vulnerability to homeowners and their families," and "degree of vulnerability to their property and possessions" on a 7 point scale with 1 = *not at all concerned/serious/vulnerable* to 7 = *very concerned/extremely serious/very vulnerable*. A composite measure was calculated from these items. Risk perception had two items measuring the factor. "Likelihood of a fire happening near their home within the next couple of years" was measured on a ten point scale with 1 = *no chance* to 10 = *certain to happen*. "What chance was there of being impacted by a wildfire" was measured as a percent with 0% = *no chance* and 100% = *certain to happen*. The two items had a correlation of r = 0.72 and a composite measure was created from these items. Lastly, perceived severity was measured by asking participants to "rate the severity of the impact of a wildfire on your lives and property." The variable was measured on a ten point scale with 1 = *no harm at all* to 10 = *extremely devastating*. Martin et al. (2009) measured perceived risk using five items, "to what extent do you feel concerned about the effects of wildfire," "how serious do you feel the negative consequences of wildfires are to you personally," "how vulnerable do you feel about the possibility of wildfire physically affecting you or your family," "How vulnerable do you feel about the possibility of wildfire affecting your property and/or possessions," and "how severe will the impact of a wildfire be where you live." The items were measured on a seven point scale with 1 = *not at all concerned/not at all serious/not at all vulnerable/no harm at all* to 7 = *very concerned/extremely*

serious/extremely vulnerable/extremely devastating. These items showed good internal consistency ($\alpha = 0.87$) and were computed into a composite measure.

This study adopted the Martin et al. (2009) measures of perceived risk due to its assessment of both probability and consequence of risk perception. Risk perceptions were assessed by five items measured on a seven point scale. The first item asked "to what extent do you feel concerned about the effects of wildfire" and was measured with 1 = *not at all concerned* to 7 = *very concerned*. The second item was "how serious do you feel the negative consequences of wildfires are to you personally," measured with 1 = *not at all serious* to 7 = *extremely serious*. The third item asked "how vulnerable do you feel about the possibility of wildfire physically affecting you or your family," measured with 1 = *not at all vulnerable* to 7 = *extremely vulnerable*. Item number four asked "how vulnerable do you feel about the possibility of wildfire affecting your property and/or possessions" with 1 = *not at all vulnerable* to 7 = *extremely vulnerable*. Last is "how severe will the impact of a wildfire be where you live" measured with 1 = *no harm at all* to 7 = *extreme devastation*. These items were assessed for internal reliability and a composite measure was created for a single measure of perceived risk.

To what extent do you feel concerned about the effects of wildfire?

Not at all concerned : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very concerned

How serious do you feel the negative consequences of wildfire are to you personally?

Not at all serious : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Extremely serious

How vulnerable do you feel about the possibility of wildfire physically affecting you or your family?

Not at all vulnerable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Extremely vulnerable

How vulnerable do you feel about the possibility of wildfire affecting your property and/or possessions?

Not at all vulnerable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Extremely vulnerable

How severe would the impact of a wildfire be where you live?

Nor at all vulnerable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Extremely vulnerability

Background Factors

Identified earlier as external factors, background factors are important elements in research to examine group differences or used to categorize groups in analysis. However in TPB, background measures have had limited support in the prediction of intentions or actual behavior. This is because the background factors have been found to be mediated by the TPB factors. Fishbein and Ajzen (2010) note that when controlling for intentions, attitudes, subjective norms, and/or perceived behavioral control, the background factors influence on behaviors is largely reduced and/or no longer significant in the model. In addition, it has been shown that demographic factors do not improve model prediction of behavior over and above intentions (Fishbein & Ajzen, 2010). This is because most background factors, like demographics, will be accounted for through participants' assessment of beliefs, attitudes, subjective norms, and perceived behavioral control.

The following will describe and operationalize background factors identified in the model. Removed from Fishbein and Ajzen (2010) TPB background factors are the individual, and information categories. Due to the above discussion, it was felt that the individual factors were not relevant to the greater model. The information factors were common in the wildfire literature as significant predictors of behaviors. For this reason, factors such as subjective knowledge and personal relevance were placed in the WMB

model. The social factors were maintained due to their importance in understanding the sample. Added to the background factors were governance and physical environment factors which were also important elements that arose in wildfire literature and will be utilized to understand the sample and test for group differences.

Social Factors

Identified by Fishbein and Ajzen, social background factors relate to demographic characteristics that influence an individual's beliefs and attitudes. Demographic characteristics are to identify and understand the individuals sampled. Seasonality and residency factors were also placed under this category of background factors. The following will operationalize these social background factors.

Demographic

Demographic measures, including education, age, gender, income, race/ethnicity, and employment were measured according to the U.S. Census. The reason for adopting these measures are twofold; first, the assessment of these types of data have been validated over many years of census data being collected and analyzed, second was to allow for the opportunity to compare collected data to census data for means of verifying population dynamics.

Seasonality

Seasonality, defined as a resident's time spent in the community during a calendar year, was assessed by Martin et al. (2009) by asking participants "how many months on average in a typical year do you live in X community?" Participants who identified they lived in the community less than five months were identified as part-time residents while

those there greater than six months were identified as full-time residents. This measure was found to be a significant and negative predictor of behavior which suggests full time residents have greater wildfire risk reduction behaviors. Another avenue of measuring seasonality is in relation to the 2010 Census survey which asked "does person X sometimes stay or live somewhere else," with a "no" or "yes" option. The Census survey has a follow up question asking the reason/location for living somewhere else with an option of "at a seasonal or second residence." Giving the wildfire context and its significant prediction of behaviors, this study will adapt the Martin et al. (2009) question to assess seasonality.

Seasonality was addressed by asking participants "How many days on average do you reside in the residence located in Prescott, Arizona?" An open-ended response was provided for participants to enter in the number of months they typically reside at the residence sampled. Just as in Martin et al. (2009) study, responses less than or equal to five months will be labeled as part-time residents and coded as "0" while responses greater than five will be labeled as full-time residents and coded as "1."

Residency

Residency is defined as the length of time a homeowner has lived or owned the dwelling. As identified in the literature review, many qualitative studies have identified length of residency as an important factor in mitigation behaviors (Collins & Bolin, 2009; Gordon et al., 2010; McCaffrey et al., 2011). Limited studies have assessed it in a quantitative context. Martin et al. (2009) in their study measured length of residency as a social-demographic variable. Though the literature does not specifically discuss

operationalization of the item, it can be inferred that the question asked was open-ended and the respondent entered the years they lived at the residence.

For this study, residency was assessed by asking participant "how many years have you lived/owned this property?" The participant was given a response line to enter in number of years.

Governance Factors

The governance category in the WMB centers on factors related to the influence of governments and association and their policies involved in wildfire protection. An important factor in this study is the influence of HOA's on homeowner mitigation actions. The following will discuss how the association factor will be measured.

Homeowners Associations

HOA is defined as the presence and influence of a homeowners association. Assessing the influence of a HOA is limited in the current literature as identified earlier (Martin et al., 2009; McCaffrey et al., 2011). This study developed measures to assess the influence of an HOA on wildfire mitigation behaviors. A question was asked concerning the membership in an HOA which was used for sample validation purposes. The questionnaire asked "is your home located in a neighborhood that has an active homeowner's association?" Participants were given "yes," "no," and "do not know" response options. The responses were coded as 1 = *yes*, 2 = *no*, and 3= *do not know*. A follow up question asked "if your home is within a homeowner's association, how would you rate the influence the association has on your actions in home and property protection

from the risk of wildfire?" This question was measured on a seven point Likert-type scale with 1 = *no influence* and 7 = *much influence*.

If your home is within a homeowner's association, how would you rate the influence the association has on your actions in home and property protection from the risk of wildfire?

No influence : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Much influence

Physical Environment Factors

In addition to social and governance background factors, the WMB introduces physical environment factors related to the individual homeowner's parcel. As with the other background factors, these are not explicitly in the model but can provide some important data in looking beyond the model in understanding mitigation behaviors. Just like the HOA measure being used as a grouping factor, these physical environment factors could be used to understand differences between the parcel characteristics. The following will describe how the measures were assessed.

Parcel Characteristics

The wildfire mitigation literature has measured parcel characteristic in a couple of ways. Brenkert-Smith et al. (2012) examined size of the lot by categorizing lots as less than a quarter acre, a quarter to two acres, and greater than two acres. Champ et al. (2013) assessed vegetation density and dangerous topography. Vegetation density was assessed by identifying "dense vegetation within 30 feet of home" or "moderately dense vegetation within 30 feet of home" where dangerous topography was assessed by identifying distance from house either less than 30 feet or 30 to 100 feet.

For this study, parcel characteristics are defined as the size, presence and type of vegetation, and topography of the parcel. Size of the lot was gathered through the use of

GIS. This information is provided as part of the parcel data acquired from Yavapai County. Vegetation and topography was also accessed through the use of GIS. Through the Arizona GEO Clearinghouse, data layers of land cover and topography have been acquired and were used for a more accurate measure of lot characteristics.

Dwelling Characteristics

For this study dwelling characteristics are defined as the type of structure use, number of stories, and construction materials. In measuring parcel characteristics, Champ et al. (2013) identified type of roof as a significant measure of risk perception and mitigation actions. This was measured through participant self reporting if their roof was wood, coded as 1, with all other materials coded as 0. There is limited literature that assesses these characteristics and their impact on mitigation.

This study asked participants to identify their type of dwelling by asking "what type of housing unit is located on the parcel owned in Prescott, Arizona?" The response options were 1 = *single family home*, 2 = *town home*, 3 = *condominium*, 4 = *apartment*, 5 = *mobile home*, or 6 = *duplex*. This question is intended to verify the sample which is focused on single family homeowners. Participants were also asked "how many stories is the house located on your parcel in Prescott, Arizona" with 1 = *one*, 2 = *two*, and 3 = *three or more*. As well as, what material the dwelling and roof is constructed of by asking "what construction material is your house made of" with response options of 1 = *wood with vinyl siding*, 2 = *wood with wood siding*, 3 = *wood with stucco siding*, 4 = *wood frame with brick siding*, 5 = *wood frame with concrete siding*, 6 = *wood frame with metal siding*, 7 = *cinder block*, and 8 = *concrete*. To assess the roof construction,

participants were asked "what type of roof is on your home?" with options of 1 = *cedar shake*, 2 = *asphalt shingles*, 3 = *metal*, and 4 = *terra cotta tiles*.

Pilot Study

A pilot study was conducted to test the proposed questionnaire and sampling procedures for the main study. This pilot study sampled a small subset of 230 individuals, 115 from each of the groups (HOA and non-HOA), to identify any issues with methods and non-response. In addition to the questions outlined above, the pilot study included open ended questions relating to the behavioral outcomes, normative referent, and control factors to identify any additional location relevant beliefs that should be considered for the main study. Data collected were used to test question and scale validity (Dillman et al., 2009). The pilot study provided a more detailed idea of the sample needed for the main study by providing an idea of expected response rate and identifying any issues with each groups (HOA and non-HOA) population list.

Test of Instrument and Scale Reliability and Validity

Data collected were entered in SPSS 21.0 and analyzed to identify item non-response concerns, reliability between paper and online responses, and validate the developed questions and scales through testing for reliability (Dillman et al., 2009). To test for the reliability of scales, a Cronbach's Alpha was calculated to test for internal consistency across items (Singleton, 2010). At this stage, individual items were reviewed to see if the removal of uncorrelated items would improve the scales internal consistency. To test for validity of the developed belief scales, the open ended responses asking homeowners to provide additional beliefs, referents, and controls were reviewed against

existing questions to identify any items that should be removed or added. The background factors were also assessed to identify their correlation with intention to mitigate wildfire risk or actual wildfire mitigation behaviors (Fishbein & Ajzen, 2010).

Given the multi response method options (mail and on-line) as outlined by Dillman et al. (2009), an assessment of response variation was conducted to verify consistency across modes. Though Dillman et al. (2009) identified little difference between the two response modes, Brenkert-Smith et al. (2012) conducted a study that employed very similar methods including a mail and on-line option for responses and found a significant difference between the two, mainly in terms of demographic characteristics including number of dependents in the household, race, employment status, age, and income. Dillman et al. (2009) noted the importance of creating good comparable questions across platforms to limit response biases. For this study, the two response options were employed to provide the best response rate possible. The study assessed whether or not the responses across platforms are significantly different.

Sampling Strategy and Sample

The population studied was owners of single family homes in and around the city of Prescott, Arizona that are located within the WUI. To provide for later analysis of HOAs' impact on wildfire mitigation behaviors, the study employed cluster sampling to account for equal representation of participants who own property in neighborhoods with and without an HOA. Participants in each cluster were randomly selected based on these neighborhood level characteristics. Working with a local realtor, neighborhoods with

associations and those without were identified. Through this contact, a list was created identifying neighborhoods and their association status.

Arc Map 10.3 GIS Software was used to develop each cluster population. Taking a WUI data layer, parcel data of the Prescott area was extracted, creating a layer of parcels within the Prescott area of study located in the WUI. Using the list developed with the local realtor, a database was created with neighborhoods identified as having an HOA. These data were joined with the WUI parcel data. As the population was single family homeowners, properties that were vacant parcels, condos, apartment, or other non-livable improvements were identified and excluded. This was done by identifying single family residential parcel improvements through the parcel layer database. A new data layer of just these improved parcels was created. Through selecting the improved parcels within an association, a list of improved residential parcels and contact information was created for homeowners in the WUI with property in an HOA. Conversely, a list of parcels and contact information was created for those not in an HOA. For a detailed flow chart for the GIS process in developing the two population lists see Figure 12 GIS Flow Chart in Appendix F. A random sample was generated from each list to produce two clusters of equal size. Parcel location and data were randomly crosschecked to validate each cluster sample.

Through working with the Yavapai County Geographical Information Systems Department, a geodatabase was acquired which includes the Prescott City boundary, Prescott area parcel data (updated 02/2016), and subdivisions data layers. Data layers developed by Martinuzzi et al. (2015) were used to identify the wildland–urban interface

and intermix within the region. In addition, Yavapai County provided a database of improved parcels and a buildings data layer for identifying improved lots.

The cluster population for single family parcels in an HOA totaled 5,677 and those not in an HOA totaled 6,481, of which 1,223 parcels are not identified as being part of a defined neighborhood. A sample size for each cluster was calculated with 360 and 363 respondents respectively based on a 95% confidence level (Dillman et al., 2009). Accordingly, this was calculated as outlined by Dillman et al. (2009) and represented in Equation 6 Sample Size. Past studies have shown response rates around 35% in similar settings and sampling design (Bourque et al., 2013; Brenkert-Smith et al., 2012). Taking these past response rates and factoring a more conservative 30% response rate, an approximate initial sample of homeowners in HOA neighborhoods is 1,200 and for non-HOA Neighborhoods 1,210. These initial samples will be round to 1,200 participants each in an attempt to provide equal numbers across clusters. Table 2 provides a segmentation of neighborhoods and dwellings per cluster.

$$N_s = \left[\left(N_p\right)\left(p\right)\left(1-p\right)\right] / \left[\left(N_p - 1\right)\left(B/C\right)^2 + \left(p\right)\left(1-p\right)\right] \quad (6)$$

Table 2

Population Statistics

	HOA Cluster	Non-HOA Cluster	Total
Number of Neighborhoods in WUI	63	170	233
Prescott	49	154	203
Yavapai	14	16	30
Number of Dwellings in WUI*	5,677	6,481	12,158
Prescott	4,619	5,416	10,035
Yavapai	1,058	1,092	2,150
Sample (95% confidence level)	360	363	723
Initial Sample (30% response rate)	1,200	1,210	2,410
Rounded Initial Sample	1,200	1,200	2,400

Note. * 1,223 dwellings not associated as part of a formalized neighborhood and are included in the non-HOA total.

Administering the Questionnaire

Dillman et al. (2009) suggested the Tailored Design Method in developing and administering a sampling plan. It "involves using multiple motivational features in compatible and mutually supportive ways to encourage high quantity and quality of response[s]…" (Dillman et al., 2009, p.16). The design minimizes coverage, sampling, non-response, and measurement errors. Brenkert-Smith et al. (2012) showed this method to be reliable and provides for a good response rate. For this study, a mail questionnaire was used because of issues with emails going to spam folders and many people disregarding emails that they don't know as well as fear of opening links in emails. The mailing method provides a means to contact homeowners though typical methods in acquiring property addresses. This is ideal as it would be difficult to acquire emails for many homeowners in the sample, especially those who reside outside of homeowner association. For these reasons, the Tailor Design Method was implemented throughout the development and administering of the study. In addition to the previously stated

reasons for utilizing this particular method, a consideration was related to cost. By utilizing an online instrument, the costs of business reply postage of returned questionnaires was reduced.

The study implemented a combined mail and on-line questionnaire instrument. This method was selected to maximize responses from homeowners living in the WUI. Based on the TPB process outlined by Fishbein and Ajzen (2010) and the specific population which will be sampled, this is the most efficient method with minimal costs and time commitments (Dillman et al., 2009).

The initial mailing included the paper questionnaire with information on how to access the web based questionnaire if desired. Located on the back of the questionnaire was a unique identifier linked to the participant's address to be used when filling out the questionnaire on-line and to note when participants have responded so subsequent mailings were not sent. This initial mailing included a cover letter describing the study, a NFPA Firewise sticker, and a postage paid business reply envelope. A week after the initial mailing a reminder postcard was sent to those who had not completed the questionnaire. The last mailing was sent out a week after the reminder postcard mailing and contained the same paper questionnaire with the respondents' unique identifier affixed to the back. The final mailing again enclosed a cover letter with directions to the online questionnaire and postage paid business reply envelope to return the completed paper questionnaire. The participant code served a number of purposes for the management of participant response and follow up. The first purpose was to identify the participants that had completed the questionnaire. Subsequent mailings were not sent to

these respondents. The second purpose was to limit access to the on-line questionnaire to only those with participant codes. The third purpose was to identify any participant who may have provided multiple responses. This could be from completing the on-line questionnaire and returning the paper questionnaire or returning multiple paper questionnaires. In these cases of multiple responses by the same participant, the first response completed was used in the study.

Respondent data were downloaded from the on-line questionnaire platform and collected from the returned postal mail questionnaires. The responses were compiled into a single database. Below discusses how these data were analyzed.

Analysis

Data were entered and cleaned in SPSS version 22 statistical package before any analysis was performed. To assess normality and any issues with these data, descriptive statistics were estimated. Means, median, modes, skewness, and kurtosis were assessed as well as histograms that were reviewed to identify non-normality and outliers. To address non-normality, invalid outliers were identified and removed.

Univariate skewness and kurtosis were assessed. It has been suggested by West, Finch, and Curran (1995) that a univariate skewness value of 2.0 and a kurtosis value of 7.0 are cutoffs for data to be considered normal. Additionally, these data were screened for missing values, though it has been identified that the social sciences commonly have missing data rates of 15% and 20% (Enders, 2003; Peugh & Enders, 2004). To handle non-normality and missing data in the path analysis models, a robust, full information maximum likelihood estimator has been used. In the Mplus statistical software package

the MLR estimation, which is a robust estimator that uses full information maximum likelihood estimation, was utilized for the model analysis.

Cronbach's alpha coefficients were used to assess the internal consistency of multi-item factors before composite measures were calculated. Items that do not contribute to the measurement of the factor were removed. It has been noted that many of the belief items will not provide good internal consistency but the indexes created still provide valid and reliable measures (Fishbein & Ajzen, 2010).

Inherent to path analysis is the omission of measurement error when including composite measures. This can create unreliable path estimates in the model. To control for measurement error, this study employed the Total Aggregation with Reliability Correction approach (Williams & O'Boyle Jr, 2008). In this approach, a latent variable is measured by a single indicator (the composite measure). A reliability estimate is obtained for the composite measure from which the unique variance is calculated. Equation 6 shows the calculation of unique variance (*UV*) by subtracting one (1) from the reliability estimate (*rel*) and multiplying the resulting value by the composite measure variance (σ^2). The unique variance is then used to fix the indicator parameter making the model identified. By using this approach, the latent variable takes on the reliable (error free) estimates (Cole & Preacher, 2014). This was calculated for each composite measure in the model.

$$UV = (1 - rel)(\sigma^2) \tag{7}$$

To assess model fit, individual parameters were assessed for expected magnitude and direction. Global fit was assessed through Chi-square test of exact fit, standardized

root mean squared residual (SRMR), comparative fit index (CFI), and the root mean square error of approximation (RMSEA). The global fit indices are assessed based on accepted values for quality of model fit with the data. For the Chi-square test of exact fit, the chi-square statistic is required to be non-significant in order to accept the null hypothesis that states the model fits the data perfectly. Good fit cutoff for the SRMR statistic is less than .08 (Hu & Bentler, 1999). The CFI should have values greater than .95 for good fit (Hu & Bentler, 1999), and the RMSEA should be less than .06 (Browne & Cudeck, 1992).

To test the specific research questions, this study employed a multi-group path analysis using Mplus version 7 statistical software package. To answer the first research question, does TPB provide a theoretical framework for measuring homeowner wildfire mitigation behaviors, the TPB model as identified in Figure 4 was tested with an unconstrained multi-group path analysis and the model fit assessed using the fit indices as stated previously.

Research question 2, does the WMB model provide a better framework over and above TPB, was also assessed through an unconstrained multi-group path analysis as identified by Figure 5. Model fit was reviewed and compared with the TPB model to identify the better fitting model. The Akaike Information Criterion (AIC) was identified from each models output and evaluated. AIC is generally used in comparing non-hierarchical models (Kline, 2011) and lower values suggest a better fitting model.

Research question 3 assessed if risk perceptions mediate the relationship between WMB predictor variables and intentions to mitigate. To assess question 3, the analysis

tested all paths as outlined in Figure 6 to identify any mediation through perceived wildfire risk. Model fit will also be compared to the first two models.

Multi-group path analysis allows for the testing of invariance (i.e. that the models are equivalent) across the groups. To assess research question four, do neighborhoods with HOAs differ from those without an HOA and how do they differ, an invariance test was conducted. This analysis was done through a series of steps with subsequent steps building off the previous (Byrne, 2012). The best fitting model identified in research question 3 was utilized for this analysis. This process is outlined by the following steps. The initial step tests the overall model's fit to the data by using the combined data set, i.e. the data from both groups. If this analysis shows poor fit to the data, the modification indices are reviewed in order to identify potential respecification of the model by freeing parameters. The model is then tested for each group separately to develop the baseline model. Again, the modification indices are reviewed if poor model fit is shown. Respecification is performed if needed to provide both parsimony and meaningfulness to the model. Any respecification to one groups' model is also done to the other to maintain an identical model which is tested further. The configural model is assessed using both groups simultaneously with no equality constraints between the two groups. This creates a model that is the least constrained with a weighted combination of both groups in the model. The next analysis then constrains the path coefficients to be equal across both groups. A Chi-square difference test is performed to see if the least constrained model is significantly different from the unconstrained model. If the Chi-square difference test is not significant then it can be assumed that the unstandardized path coefficients are equal

across the groups suggesting that they are invariant. If the Chi-square difference test is significant then the assumption is that the two groups are not invariant suggesting that at least one path coefficient is different across the groups. To identify the path coefficients that are not equal across the groups, modification indices are reviewed to see which path coefficients differ across the groups (Byrne, 2012).

Background factors were explored for group difference through analysis of variance. Addition analyses were explored to identify how significant differences impact mitigation behaviors.

RESULTS

Interview Results

A total of eight semi-structured interviews were completed during the Fall of 2015 (September 24th – December 13th). After completing the eight interviews saturation of responses were achieved. All interviews were conducted in the Prescott area either at the participant's home or a local cafe. The interviews ranged in length from forty-five minutes to an hour and half.

Interview responses suggested the importance of HOAs in wildfire mitigation behaviors of homeowners. This is from dissemination of information to creating policies requiring regular maintenance. In addition, interviews revealed concerns of neighboring landowner's lack of mitigation, unimproved lots, and lack of municipal policies to enforce mitigation actions. Many themes were developed through the interviews and are discussed below.

Relating Background Factors to Mitigation

Employment

Participants in the one-on-one interviews identified some important dynamics with employment and mitigation behaviors. Obviously, the more time a resident has at the residence the more opportunity there is to complete mitigation actions. Many participants interviewed were in neighborhoods with a higher percentage of retired individuals. It was noted that these neighborhoods had "a positive and very active" support for mitigation of their property to reduce wildfire risk. There were many comments about resident's being "very supportive of firewise designation". As retired

residents age, their ability to perform these actions personally is reduced through limited physical ability. There were also two caveats concerning retired residents that came from the interviews. One was that these residents, at least in the more affluent neighborhoods, retired at their highest earning potential with a good retirement plan and can afford to mitigate their property. It was also noted that retired residents could be on a fixed income limiting their ability to perform these actions.

Seasonality and Residency

Seasonality varied among neighborhoods with participants noting "just a few part-time residents [lived in the neighborhood]" while others noted that up to "forty percent [did] not live in the neighborhood" or "majority of the residents are part time." One participant noted that new or seasonal residents are a concern "because they want all the trees they can for privacy and they don't want to cut down anything." Neighborhoods with many seasonal residents could have more concerns of homeowners not mitigating their property. Full-time permanent residency is important for mitigation actions noting that "just about all the permanent residence have taken advantage."

Homeowner Associations

Some unique dynamics emerged from the interviews concerning HOAs. It was noted that neighborhoods that do not have an HOA need a champion to promote firewise. Organized neighborhoods create a central point for dissemination of information creating awareness and providing education of risks as well as appropriate risk reduction actions to take concerning wildfire. Some responses noted the creation of a line item in the budget for mitigation of common property and of lots posing wildfire risks. Also derived

from the participant responses was an issue of organized neighborhoods, especially those with strong HOA's, are typically the ones that apply for and receive grant funding. This creates a potential disparity with non-HOA neighborhoods that do not have a "champion."

Within HOA neighborhoods, there is a range of activeness and strength of the board. Cohesive neighborhoods tend to lead toward strong and active boards. While divided neighborhoods can lead to or be caused by a dysfunctional board. Boards can be influenced by a unifying or dividing individual in the leadership role. In this respect it is not only important to identify if the neighborhood has an HOA when understanding its influence on mitigation but also knowing the strength of the HOA is a critical element in its influence.

Other Qualitative Themes

Policies, Rules, and Regulations

The results showed that there are concerns around the lack of county and city regulations for firewise maintenance. Though Prescott has a requirement that vacant land be mitigated before permits will be approved for new construction, there are no regulations for existing home and property nor are there regulations for firewise maintenance on either improved or unimproved lots. Participants noted that because of the "lack of city regulations, HOAs have no teeth to enforce firewise," even when HOA's "… have resolutions…" In other words, municipality firewise codes and regulations would make it easier to put in place and enforce firewise regulations.

Specifically concerning HOAs, some have taken measures to try and bolster their ability to encourage and enforce mitigation. Many are trying to rewrite or amend their Covenance, Conditions, and Restrictions (CC&R) to include firewise maintenance language and requirements. However, these actions have been met with resistance or not enough involvement by the neighborhood residents to get the required number of votes to pass. Creation of resolutions has been done in some cases but these, again, are not enforceable. Fining was very limited among HOA's with participants suggesting the reasons for this are due to either having no rules in place to back up the fines, as identified earlier, and a fear of losing community relations.

Firewise Support

In continuing with HOA strength, another dynamic that came from the interview responses is that functional HOAs have strong and active support for Firewise in the neighborhood. It was also identified that mainly full-time residents are supportive which also tend to be the homeowners that primarily mitigate, whereas, part-time or seasonal residents do not have the same level of awareness as full-time residents and therefore have limited performance of mitigation action on their property.

Unimproved Lots

A major concern among neighborhood leaders was the issue of unimproved lots. Participants suggested that many of these are out of state land owners who purchased the property as an investment. The lots often are within either the firewise zone 2 or zone 1 of an adjacent home. The issues are that an absentee landowner does not see the fire risk the property poses and/or is not even aware of the potential of wildfire risks. The

absentee land owners tend to be difficult to contact. Another caveat was many are in the process of trying to sell the property and do not want to spend any money on the lot which would cut into their profit. Needless to say, unimproved lots pose a serious risk to structures in the neighborhood.

Adjacent Lands

A number of comments arose about adjacent lands and their threat to neighborhoods. This was the case for state, county, and city lands as well as adjacent neighborhoods that were not mitigated. Many of these lands are also within the Firewise zones 2 or 1 from a structure. A major issue is that there is no control over these lands to mitigate which brings the issue of creating city and/or county regulations.

Grants

Though grants have provided a catalyst for mitigation actions in many neighborhoods, initial grants are only good one time. This poses an issue with continued maintenance of properties. Another concern is the limited funding available for unimproved lots, though there are some ethical concerns with that such as a property owner having the lot mitigated which improved the value and helped it sell. Not to mention the concerns with non-HOA neighborhoods.

Other Concerns

A number of other concerns were identified that are worth mentioning. Neighborhoods with primarily retired residents noted a concern for an aging population and the limitation this will pose on continued maintenance not only from a physical capability stand point but also from a financial one with many potentially on a fix

income. This leads into another series of comments about concerns of finding contractors who are knowledgeable about firewise strategies and are affordable. Also noted was the constraint of the landscape in performing mitigation actions. Some lots are so steep that contractors will not take on the job. This poses a real issue in mitigating.

Neighborhood Assessment

The neighborhood assessments were completed to gain more insight into the current built and natural landscape in and around Prescott area neighborhoods. In addition, this information provided a way to verify that a range of interviews from neighborhood leaders were completed in different scenarios. Table 3 provides a breakdown of these neighborhood assessments. Four neighborhoods were assessed within the City of Prescott boundaries and four outside the boundaries located in Yavapai County. Neighborhoods in the city are largely adjacent to State Trust lands while neighborhoods outside of the city assessed had City of Prescott lands adjacent. The neighborhoods assessed were located in pinion juniper woodlands with two county neighborhoods located in montane conifer forests. All had extreme topography with steep valleys, high ridges, or located on a mountain.

Table 3

Neighborhood Assessment Results

Case	Location	Neighborhood		Mean Parcel Size	Dwelling		Bordering Lands		Primary	
		Size[a]	% Developed[b]		Stories[c]	Type[d]	Public	Private[e]	Vegetation	Topography
1	County	Large	54.5%	¾ acre	Mixed	Mixed	National Forest	None	Montane Conifer Forest	Valley
2	City	Small	76.7%	½ acre	Mixed	Stick Built	State Trust & City	Neighborhood	Pinyon Juniper Woodlands	Ridge
3	City	Medium	83.3%	1 acre	Mixed	Stick Built	State Trust & County	Neighborhood	Pinyon Juniper Woodlands	Valley
4	County	Medium	33.7%	¼ acre	Multi	Stick Built	None	Neighborhood	Pinyon Juniper Woodlands	Valley
5	County	Large	79.5%	½ acre	Mixed	Stick Built	City	Neighborhood	Montane Conifer Forest	Valley
6	City	Medium	70.7%	¼ acre	Mixed	Stick Built	National Forest & County	Neighborhood	Pinyon Juniper Woodlands	Ridge
7	County	Small	59.0%	½ acre	Multi	Stick Built	City	Neighborhood	Pinyon Juniper Woodlands	Mountain
8	City	Small	64.2%	¼ acre	Multi	Mixed	State Trust, County, & City	Neighborhood	Pinyon Juniper Woodlands	Mountain

[a] Size is based on number of parcels located within the neighborhood. Small = <100 parcels, Medium = 101 to 200 parcels, Large = >201parcels.

[b] The percent of developed parcels based on total neighborhood parcels.

[c] Dwelling stories are one, multiple, and mixed.

[d] Dwelling type are stick built, brick/block built, and mixed.

[e] Bordering private lands are neighborhoods and commercial.

Study Results

This section trasitions from interview results to responses from the mailback questionnaire sent to study participants. These results are organized to display each group (HOA & non-HOA) separately as individual case studies.

Response Rate and Sample

Overall, 2,409 questionnaires were mailed out (1,204, HOA and 1,205, non-HOA). Respondents were provided the option of responding via the enclosed paper questionnaire or via an online version. The overall study response rate was 28%, with the identified respondents within an HOA having a 30% response rate while respondents identified as living in a non-HOA neighborhood having a 26% response rate. Returned mail identified 118 addresses that were either not deliverable, addressee had moved, or addressee was deceased. Of the 644 questionnaires returned, online response provided less than a quarter of all responses (22.1%). Forty seven (7.3%) of the completed questionnaires had missing responses of one page or more; of which a total of five cases were removed due to missing data on all model variables. Other cases removed (4) were due to respondents identifying the dwelling as other than a single family home. The data show that eighty-one respondents between both sample (HOA and non-HOA) identified a contradicting HOA situation. The HOA sample had fifty-nine respondents that identified their dwelling was not located in an HOA while twenty-two respondents in the non-HOA sample self reported that their home was in an HOA. With this adjustment to each group, the final sample was 305 respondents in the HOA sample and 330 respondents in the

non-HOA sample for a total sample of 635. Table 4 shows the population sample and participant responses.

Table 4

Response Rate

	HOA		Non HOA		Totals	
Initial Sample	1204		1205		2409	
Undeliverable	55	4.6%	63	5.2%	118	4.9%
Adjusted Sample	1149		1142		2291	
Response Rate	349	30.4%	294	25.7%	644*	28.1%
Online	*86*	*24.6%*	*56*	*19.1%*	*142*	*22.1%*
Paper	*263*	*75.4%*	*238*	*80.9%*	*501*	*77.9%*
Incomplete	22	6.3%	25	8.5%	47	7.3%
Cases Removed	7		2		9	
HOA Self Reported Adj.	-37		+37		-	
Final Group Totals	305		330*		635	

Note. *One case with no participant code could not be included with initial response totals due to lack of HOA identification. Response was added to non-HOA sample based on self reported assessment.

Respondent Demographics

Respondents were mostly full-time residents (84% HOA & 92% Non-HOA) in their mid to late sixties and retired (see Table 5). Property ownership within an HOA averaged nine years while Non-HOA respondents averaged ownership of sixteen years. The HOA respondents were mostly white (97%) and educated (71% with a bachelor degree or higher) making a household income of $75,000 to $89,999. Non-HOA respondents were also mostly white (93%) with about half (58%) completing a bachelor degree or higher and making a household income of $60,000 to $74,999.

Table 5

Respondent Demographics

Variable	HOA	Non-HOA
Seasonality		
Absentee land owner (%)	1.3	1.8
Part time residence (%)	14.3	6.4
Full time residence (%)	84.3	91.7
Ownership (mean years)	9.2	15.9
Gender (% male)	64.4	46.8
Age (mean years)	68.9	65.1
Race (% White)	97.1	93.5
Income (median category)	$75,000-$89,999	$60,000-$74,999
Education (% bachelor or higher degree)	71.4	57.6
Employment (% retired)	66.0	53.9

Descriptive Statistics

The descriptive statistics were explored across both modes of use (on-line and paper questionnaires) to identify any differences. There was one demographic variable in each sample (HOA and non-HOA) that was significantly different across response modes. Respondents who lived in an HOA had a significant age difference between response modes with those completing a paper questionnaire having an average age of 67 and respondents completing the on-line questionnaire having an average 72. For the non-HOA sample, length of residence was significantly different with respondents to the paper questionnaire having an average residency of seventeen years while on-line respondents only averaged ten years.

Indirect Factors

This section presents the descriptive statistics and development of composite measures for the indirect factors of behavioral belief, normative belief, and control belief. To measure behavioral beliefs, a set of nine items were asked. Each item responses were

calculated by multiplying the belief strength variable with the corresponding outcome variable. The resulting measures' descriptive statistics are presented in Table 6. These items are then summed to create a behavioral belief composite measure as identified in Equation 1 (see page 63). Each item presented a normal distribution with no extreme skewness or kurtosis. Two items, "comes at a significant cost" and "will not stop a fire," were worded negatively. Reverse coding of these items was explored. The two item means were low and were not consistent with the rest of these data. A review of the responses identified some concerns with respondents not answering the question appropriately due to the negative wording. These two items were removed from the final composite measure. Two more items "provides privacy" and "improves appearance" did not contribute to the internal reliability of the measure and were also removed from the composite measure calculation. The five remaining items used to create the behavioral belief composite measure had a good internal reliability of $\alpha = 0.946$ for the HOA group and $\alpha = 0.938$ for the non-HOA group. As identified in Table 17, the HOA sample had a mean of 79.38 and the non-HOA sample had a mean of 75.63 out of a range of ±105 (Table 17). These suggest an overall positive belief toward mitigation behaviors.

Table 6

Behavioral Belief Item Descriptive Statistics

	HOA				Non-HOA			
Item	*M*	*SD*	g_1	g_2	*M*	*SD*	g_1	g_2
Sense of security[†]	15.26	6.31	-0.86	-0.23	15.16	6.53	-0.90	-0.25
Safety for my family[†]	16.29	5.68	-1.07	0.20	15.97	5.89	-1.13	0.52
Protect property value[†]	16.03	6.02	-1.03	-0.04	15.16	6.44	-0.85	-0.32
Provide privacy	12.51	7.60	-0.32	-1.26	12.18	7.54	-0.34	-1.03
Comes at significant cost[a]	1.64	8.02	0.43	0.73	0.68	7.78	0.11	1.66
Reduces impacts[†]	15.26	6.77	-1.17	0.98	14.68	7.01	-0.76	-0.68
Protects belongings[†]	15.26	6.45	-0.90	-0.21	14.87	6.63	-0.81	-0.35
Improves appearance	13.51	7.41	-0.58	-0.81	12.86	7.27	-0.42	-0.96
Will not stop a fire[a]	8.89	8.39	-0.86	0.73	8.21	8.36	-0.74	0.81

Note. *M* = mean. *SD* = standard deviation. g_1 = Skewness. g_2 = Kurtosis. Item range is -21 = "negative belief," 21 = "positive belief." Questions 24 & 25.

[†]Item used in composite measure.

[a]Item reverse coded.

Normative belief was measured as injunctive and descriptive norms. The items used for each composite measure are presented in Table 7. Just as with the behavioral belief items, each was calculated from two sets of questions. Each item had a normal distribution with no extreme skewness or kurtosis present. One item, "HOA's thoughts," was removed from the injunctive composite measure due to the majority of non-HOA respondents identifying the question as not applicable. In addition, four other items, "undeveloped property owner's actions," "renter's actions," "out of state property owner's actions," and "seasonal resident's actions" were not included in the final composite measure. This was due to the items impacting the internal consistency and prediction capability of the composite measure. All items were explored in a factor analysis and these four items loaded on a separate factor suggesting they are measuring a separate construct. The final eight items were used to calculate the two composite measures as outlined by Equation 2 and 3 (see page 67). The items provided a good

internal reliability with the HOA and non-HOA samples for injunctive (α = 0.908 & α = 0.922 respectively) and descriptive beliefs (α = 0.886 & α = 0.873 respectively). Injunctive norm had a mean of 34.77 for the HOA sample and 21.28 for the non-HOA sample (Table 17). Descriptive norm had means of 32.94 for the HOA sample and 17.19 for the non-HOA sample. Both measures had a range of ±84. The means suggests a somewhat positive overall normative belief toward the influence of referent's influence related to wildfire mitigation.

Table 7

Normative Belief Item Descriptive Statistics

	HOA				Non-HOA			
Item	*M*	*SD*	g_1	g_2	*M*	*SD*	g_1	g_2
Neighbor's thoughts[†]	7.12	8.85	-0.12	0.06	4.01	8.66	0.37	0.54
Friend's thoughts[†]	6.82	8.85	0.04	-0.37	3.93	8.69	0.37	0.49
Family's thoughts[†]	10.27	9.86	-0.52	-0.47	5.51	9.99	-0.04	-0.17
HOA's thoughts	11.36	9.46	-0.77	-0.07	-	-	-	-
Municipality's thoughts[†]	10.04	9.76	-0.57	-0.29	7.86	10.10	-0.44	-0.03
Neighbor's actions[‡]	6.19	8.07	0.47	-0.56	2.27	7.88	0.79	1.03
Friend's actions[‡]	7.17	8.21	0.43	-0.97	3.48	8.09	0.71	0.45
Family's actions[‡]	10.42	9.72	-0.46	-0.742	6.58	9.42	0.15	-0.77
Undeveloped property owner's actions	-0.83	5.05	2.11	7.73	-1.69	5.36	1.69	7.26
Full-time resident's actions[‡]	8.81	8.00	-0.06	-0.36	5.48	8.30	0.32	-0.42
Renter's actions	-2.03	4.99	1.43	9.61	-2.44	4.24	2.31	13.51
Out of state property owner's actions	-0.85	5.71	1.56	6.11	-1.71	5.06	2.40	9.37
Seasonal resident's actions	0.60	6.29	1.32	3.29	-0.75	5.96	1.97	5.37

Note. *M* = mean. *SD* = standard deviation. g_1 = Skewness. g_2 = Kurtosis. Item range is -9 = "negative belief," 9 = "positive belief." Questions 30, 31, 32, 33.

[†]Used in index measure of injunctive norm.

[‡]Used in index measure of descriptive norm.

Control belief items presented in Table 8 were used to calculate the associated composite measure. The items represent the power control variable multiplied by their corresponding control belief strength variable as identified in Equation 4 (see page 71).

The items did not have any extreme skewness or kurtosis. Though items were reverse coded, the three negatively worded items, "debilitating illness," "fixed income," and "daily obligations" performed poorly in the reliability analysis and showed a low communality with the other predictors. In a factor analysis, the three items also loaded on a separate factor. These three items were therefore not included in the final composite measure. The internal reliability of the HOA and non-HOA samples were moderate (α = 0.679 & α = 0.700 respectively). The control belief measure had a mean of 32.57 for the HOA sample and 30.05 for the non-HOA sample (Table 17). With a range of ±63, respondents believe they have a moderate level of control over completing wildfire mitigation actions.

Table 8

Control Belief Item Descriptive Statistics

	HOA				Non-HOA			
Item	*M*	*SD*	g_1	g_2	*M*	*SD*	g_1	g_2
Physical fitness[†]	11.23	9.32	1.17	1.67	11.31	9.02	-0.99	1.14
Debilitating illness[a]	-10.53	10.81	1.14	0.66	-10.40	11.65	1.34	1.17
Fixed income[a]	-2.47	9.44	0.14	0.66	-3.34	10.11	0.22	0.28
Mitigation knowledge[†]	12.76	8.84	-1.20	1.52	10.58	9.66	-0.83	0.22
Daily obligations[a]	4.54	117.47	0.10	-0.91	1.62	10.83	0.46	-0.60
Appropriate tools[†]	8.48	9.72	-0.49	-0.20	8.16	9.98	-0.65	0.36

Note. *M* = mean. *SD* = standard deviation. g_1 = Skewness. g_2 = Kurtosis. Item range is -21 = "negative belief," 21 = "positive belief." Questions 39 & 40.

[†]Used in index measure.

[a]Item reverse coded.

Direct Factors

The following section presents the direct factors used in the study. Items used to assess the direct measures of attitude are presented in Table 9. These items were measured with a series of semantic differential scales with objective pairs. Means of the

items show a strong positive attitude toward wildfire mitigation actions. This helps to explain the extreme skewness and kurtosis identified in many of the items. The items were consistent between the two groups but the non-HOA sample had slightly lower rating on each item when compared to the HOA sample. One item was removed (Unenjoyable/enjoyable) due to negatively impacting internal reliability. The eight items used for the composite measure had good internal reliability with $\alpha = 0.934$ for the HOA sample and $\alpha = 0.947$ for the non-HOA sample. Means, presented in Table 17, show a positive attitude toward mitigation behaviors with 6.47 for the HOA sample and 6.29 for the non-HOA sample.

Table 9

Attitude Toward Wildfire Mitigation Item Descriptive Statistics

	HOA				Non-HOA			
Item	*M*	*SD*	g_1	g_2	*M*	*SD*	g_1	g_2
Harmful/Beneficial†	6.59	0.78	-2.46	7.37	6.49	0.86	1.87	3.48
Bad/Good†	6.59	0.85	-2.84	9.71	6.40	1.11	-2.58	7.78
Worthless/Valuable†	6.47	1.02	-2.47	6.79	6.33	1.15	-2.35	6.34
Foolish/Wise†	6.58	0.97	-3.36	13.38	6.35	1.29	-2.64	7.18
Useless/Useful†	6.52	0.99	-2.77	9.09	6.30	1.26	-2.55	7.09
Punishing/Rewarding†	6.04	1.33	-1.40	1.55	5.95	1.41	-1.54	2.20
Unenjoyable/Enjoyable	5.34	1.67	-0.66	-0.44	5.06	1.83	0.73	-0.40
Undesirable/Desirable†	6.32	1.22	-2.36	6.08	6.08	1.35	-1.82	3.30
Unimportant/Important†	6.55	0.95	-2.79	9.02	6.30	1.24	-2.49	6.98

Note. *M* = mean. *SD* = standard deviation. g_1 = Skewness. g_2 = Kurtosis. Item range is 1 = "negative attitude," 7 = "positive attitude." Question 23.

†Used in composite measure.

Subjective norms were assessed by four items as presented in Table 10. These items show respondents in both HOA and non-HOA groups had a moderate to high level of subjective norms concerning wildfire mitigation. These items showed no extreme skewness or kurtosis. One item, "referent action," was not included in the composite

measure due to its negative impact on the internal consistency with the other items. The internal reliability of the three items was acceptable with α = 0.735 for the HOA sample and α = 0.776 for the non-HOA sample. The composite measure shows a moderate level of normative influence related to wildfire mitigation behaviors with means of 5.98 for the HOA sample and 5.60 for the non-HOA sample (Table 17).

Table 10

Subjective Norm Item Descriptive Statistics

	HOA				Non-HOA			
Item	*M*	*SD*	g_1	g_2	*M*	*SD*	g_1	g_2
Referent opinion[a†]	5.95	1.38	-1.41	1.71	5.46	1.627	0.86	0.03
Referent approval[b†]	6.23	1.15	-1.95	4.55	5.95	1.35	-1.36	1.54
Normative expectations[c†]	5.77	1.56	-1.36	1.22	5.31	1.89	-0.92	-0.21
Referent action[d]	5.11	1.57	-0.74	-0.04	4.23	1.83	-0.17	-0.84

Note. *M* = mean. *SD* = standard deviation. g_1 = Skewness. g_2 = Kurtosis. Question 26, 27, 28, & 29.

[a]Most people think: 1 = "I should not mitigate," 7 = "I should mitigate."

[b]Most people approve of mitigation. 1 = "Strongly disagree," 7 = "strongly agree."

[c]It is expected I complete mitigation actions. 1 = "Definitely false," 7 = "definitely true."

[d]Most residents have completed mitigation actions. 1 = "Definitely false," 2 = "definitely true."

[†]Used in composite measure.

Perceived behavior control was measured through five items. Table 11 shows that respondents had an average behavioral control of moderate to high for both the HOA and Non-HOA groups. There is no indication of extreme skewness or kurtosis. Internal reliability of the composite measure items was α = 0.887 for the HOA sample and α = 0.896 for the non-HOA sample. Table 17 presents the means which show a moderate perception that one has the ability to complete mitigation actions with 5.71 for the HOA sample and 5.38 for the non-HOA sample based on a 1-7 point scale.

Table 11

Perceived Behavioral Control Item Descriptive Statistics

	HOA				Non-HOA			
Item	*M*	*SD*	g_1	g_2	*M*	*SD*	g_1	g_2
Ease of completing[a†]	5.08	1.52	-0.67	-0.04	4.70	1.73	-0.35	-0.73
Confident in completing[b†]	6.03	1.35	-1.73	2.83	5.65	1.64	-1.24	0.75
Ability to complete[c†]	6.06	1.24	-1.60	2.50	5.57	1.57	-1.12	0.65
Control over mitigation[d†]	5.84	1.52	-1.45	1.52	5.75	1.56	-1.37	1.30
Event impacting action[e†]	5.51	1.64	-1.13	0.52	5.22	1.74	-0.81	-0.20

Note. *M* = mean. *SD* = standard deviation. g_1 = Skewness. g_2 = Kurtosis. Questions 34, 35, 36, 37, & 38.

[a]For myself to complete mitigation actions is: 1 = "extremely difficult," 7 = "extremely easy."

[b]I am confident that if I wanted to I could complete mitigation actions. 1 = "false," 7 = "true."

[c]For me to complete mitigation actions is: 1 = "impossible," 7 = "possible."

[d]I feel in complete control whether I perform mitigation actions. 1 = "Definitely false," 7 = "definitely true."

[e]The number of events outside my control which could prevent me for performing mitigation actions are: 1 = "numerous," 7 = "very few."

[†]Used in composite measure.

Personal experience of wildfire shows that respondents with property not in an HOA as having slightly more years of experience as well as being impacted by more wildfire events (Table 12). Overall measure of experience is detailed in Equation 5 on page 85 in the methods section. Table 17 identifies elements of this equation for each item. The Personal Experience Severity (PES) presents a preliminary calculation of the number of experience, experience severity index, and years of experience combined. As per Equation 5, these values are summed and divided by the highest value to calculate the composite measure. With values from 0 to 1, mean personal experience for the index measure was quite low with 0.07 for the HOA sample and 0.08 for the non-HOA sample (Table 17).

Table 12

Personal Experience Item Descriptive Statistics

	HOA			Non-HOA		
Experience	*Exp*	*Years*	*PES*	*Exp*	*Years*	*PES*
Wildfire between 20 to 50 miles from property	2.10	6.18	7.69	2.17	7.02	8.96
Wildfire between 10 to 20 miles from property	0.84	4.16	5.32	1.03	4.49	6.18
Wildfire within 10 miles of property	0.49	3.01	4.10	0.68	3.71	5.58
Prepared to evacuate property	0.30	1.78	2.95	0.26	1.91	2.97
Evacuated property	0.10	0.92	1.42	0.06	0.61	0.93
Home, structure, and/or property damaged	0.01	0.01	0.06	0.01	0.12	0.23
Home, structure, and/or property destroyed	0.01	0.11	0.18	0.01	0.08	0.17

Note. *Exp* = Mean number of experiences. *Years* = Mean number of years since first experience. *PES* = Personal Experience Severity (*Years + (Exp.*Severity))*. Question 12

Table 13 presents the subjective knowledge items. Responses suggest a moderate to high level of subjective knowledge on wildfire risk and mitigation. HOA respondents showed a slightly higher set of means than the non-HOA respondents. No extreme skewness or kurtosis was identified. Internal reliability was acceptable for the HOA sample ($\alpha = 0.732$) but was low for the non-HOA sample ($\alpha = 0.537$). Composite measure means suggest a fairly high level of subjective knowledge for the HOA (6.00) and non-HOA (5.73) samples (Table 17).

Table 13

Subjective Knowledge Item Descriptive Statistics

	HOA				Non-HOA			
Item	*M*	*SD*	g_1	g_2	*M*	*SD*	g_1	g_2
Informed[a†]	5.90	1.24	-1.47	2.59	5.63	1.36	-1.08	0.98
Personal relevance[b†]	6.17	1.19	-1.66	2.62	5.98	1.40	-1.56	2.13
Motivation[c†]	5.93	1.25	-1.26	1.36	5.56	1.53	-0.99	0.35

Note. *M* = mean. *SD* = standard deviation. g_1 = Skewness. g_2 = Kurtosis. Questions 9, 10 & 11.

[a]How well informed do you consider yourself to be about wildfire? 1 = "not at all informed," 7 = "very informed."

[b]To what extent do you find information about wildfires to be personally relevant? 1 = "Not at all relevant," 7 = "very relevant."

[c]How motivated are you to learn about wildfire risk and mitigation? 1 = "not at all motivated," 7 = "very motivated."

[†]Used in composite measure.

Locus of responsibility was measured using eight items. Table 14 presents each item's descriptive statistics. One instance of extreme skewness and Kurtosis was identified for the "myself" item in the HOA sample (g_1 = -2.39, g_2 = 7.98). These extremes could be from a strong sense of self reliance of respondents. Also in the HOA sample, "Bureau of Land Management" had extreme skewness (g_1 = 2.01). The "homeowner association" item was not included in the composite measure due to many non-HOA respondents marking the item as not applicable. These items, minus "homeowner association," had a good internal reliability with α = 0.873 for the HOA sample and α = 0.877 for the non-HOA sample. The overall means for locus of responsibility for each sample were moderate to high with 5.52 for the HOA sample and 5.42 for the non-HOA sample (Table 17).

Table 14

Locus of Responsibility Item Descriptive Statistics

	HOA				Non-HOA			
Item	*M*	*SD*	g_1	g_2	*M*	*SD*	g_1	g_2
Myself†	6.46	0.93	-2.39	7.98	6.19	1.17	-1.73	3.07
My neighbors†	5.82	1.36	-1.37	1.84	5.25	1.59	-0.81	0.11
Homeowner association	5.78	1.44	-1.30	1.26	-	-	-	-
City of Prescott†	5.39	1.60	-0.98	0.38	5.36	1.75	-1.00	0.14
County of Yavapai†	5.24	1.67	-0.87	0.05	5.25	1.73	-0.86	-0.12
State of Arizona†	4.75	1.83	-0.50	-0.73	4.94	1.89	-0.63	-0.67
Bureau of Land Mgt.†	4.66	2.01	-0.58	-0.89	4.96	1.99	-0.74	-0.64
USDA Forest Service†	5.45	1.78	-1.20	0.52	5.36	1.88	-1.11	0.231

Note. *M* = mean. *SD* = standard deviation. g_1 = Skewness. g_2 = Kurtosis. Measured on a 7 point scale, 1 = "not at all responsible", 7 = "very responsible." Question 19.

†Used in composite measure.

Table 15 presents six items used to calculate the perceived wildfire risk composite measure. The items have no extreme skewness or kurtosis. The HOA group consistently identified slightly higher levels of perceived risk than those in the non-HOA group. Table 17 presents the internal reliability of the measures with the HOA sample having $\alpha = 0.872$ and the non-HOA sample with $\alpha = 0.882$. The perceived wildfire risk measure showed that both HOA and non-HOA samples had a moderate level of risk with means at 5.40 and 5.13 respectively.

Table 15

Perceived Wildfire Risk Item Descriptive Statistics

	HOA				Non-HOA			
Item	*M*	*SD*	g_1	g_2	*M*	*SD*	g_1	g_2
Concern about effects[a†]	6.00	1.27	-1.34	1.45	5.76	1.46	-1.24	1.11
Seriousness of wildfire[b†]	5.90	1.25	-1.16	1.02	5.67	1.59	-1.21	0.75
Vulnerability of family[c†]	4.69	1.61	-0.43	-0.45	4.50	1.73	-0.22	-0.74
Vulnerability of property[d†]	4.76	1.53	-0.34	-0.52	4.41	1.71	-0.16	-0.78
Severity of impact[e†]	5.91	1.43	-1.31	1.02	5.75	1.66	-1.28	0.69
Concern of adjacent prop[f†]	5.14	1.67	-0.63	-0.51	4.72	1.86	-0.45	-0.85

Note. *M* = mean. *SD* = standard deviation. g_1 = Skewness. g_2 = Kurtosis. Questions 13, 14, 15, 16, 17, & 18.

[a]To what extent do you feel concerned about the effects of wildfire? 1 = "not at all concerned," 7 = "very concerned."

[b]How serious do you feel about the negative consequences of wildfire? 1 = "not at all serious," 7 = "extremely serious."

[c]How vulnerable do you feel of wildfire affecting you or your family? 1 = "not at all vulnerable," 7 = "extremely vulnerable."

[d]How vulnerable do you feel of wildfire affecting your property? 1 = "not at all vulnerable," 7 = "extremely vulnerable."

[e]How severe would the impact of wildfire be where you live? 1 = "not at all severe," 7 = "extremely sever."

[e]To what extent do you feel concerned about adjacent properties? 1 = "not at all concerned," 7 = "very concerned."

†Used in composite measure.

The last set of measures was intention to mitigate and mitigate action. Two measures of each were calculated to address the differences in annual maintenance and more one time construction actions on the house and property. Table 16 shows the percentage of intentions and actual behavior for each action assessed. Overall, intentions to mitigate had lower percentages than actual mitigation actions. The HOA sample had higher intentions and actual actions when compared to the non-HOAsample. Maintenance intentions identified that HOA respondents intend to complete, on average, 49% of possible actions on their property (Table 17). The non-HOA sample identified respondents intend to complete only 33% of possible action. Looking at intentions to

complete construction mitigation, we see the HOA sample with only 17% intention of possible actions while the non-HOA sample had 11%. Actual maintenance and construction actions were higher with the HOA sample completing, on average, 55% and 22% of possible actions on their property and home, respectively. The non-HOA sample identified respondents completed on average 38% and 17% of possible actions on their property and home, respectively.

Table 16

Overall Percent of Mitigation Intention and Action

	HOA		Non-HOA	
Action	Intention to Mitigate[a] (%)	Mitigate Action[b] (%)	Intention to Mitigate[a] (%)	Mitigate Action[b] (%)
Maintenance actions				
Roof & rain gutters kept free of debris	38.0	29.5	24.2	23.3
Branches removed within 10 ft. of roof	47.5	59.3	39.1	38.5
Grass maintained 30 ft. around home	39.0	36.4	23.9	23.0
Thinned vegetation within 30 ft. of home	53.1	60.7	36.7	38.8
Shrubs & lower tree branches removed	55.7	63.0	37.0	39.1
Dead veg. cleared within 30 ft. of home	46.9	66.2	35.2	45.5
Construction actions				
Fire wood stacked 30 ft. away from home	19.3	22.3	17.3	30.0
Home has fire resistant roof	8.5	33.1	4.2	24.8
Home has screening on all vents	12.5	20.0	7.6	15.5
Home construction material is resistant	5.9	16.4	3.6	12.7
Underside of deck is enclosed	8.9	11.1	6.4	7.9
Yard landscaped with fire resistant vegetation	11.8	16.7	6.7	9.7

Note. [a]Question 22. [b]Question 21

Table 17

Model Variable's Descriptive Statistics

	HOA				Non-HOA			
Measure	*n*	*M*	*SD*	*α*	*n*	*M*	*SD*	*α*
TPB Indirect Factors								
Behavior Belief[a]	278	79.38	27.48	0.946	294	75.63	29.27	0.938
Injunctive Norm Belief[b]	266	34.77	33.04	0.908	263	21.28	33.53	0.922
Descriptive Norm Belief[b]	256	32.94	29.55	0.886	261	17.19	28.68	0.873
Control Belief[c]	283	32.57	21.78	0.679	299	30.05	22.66	0.700
TPB Direct Factors								
Attitude[d]	280	6.47	0.83	0.934	290	6.29	1.03	0.947
Subjective Norm[e]	290	5.98	1.11	0.735	306	5.60	1.34	0.776
Behavioral Control[f]	285	5.71	1.21	0.887	307	5.38	1.39	0.896
Intention to mitigate								
Maintenance Intentions[g]	305	0.49	0.38	-	330	0.33	0.36	-
Construction Intentions[h]	277	0.17	0.34	-	294	0.11	0.29	-
Actual Mitigate Behavior								
Maintenance Actions[g]	305	0.55	0.35	-	330	0.38	0.36	-
Construction Actions[h]	304	0.22	0.32	-	328	0.17	0.27	-
Wildfire Direct Factors								
Perceived wildfire Risk[i]	297	5.40	1.15	0.872	326	5.13	1.33	0.882
Personal Experience[j]	265	0.07	0.09	-	289	0.08	0.10	-
Subjective Knowledge[k]	302	6.00	0.99	0.732	324	5.73	1.03	0.537
Locus of Responsibility[l]	257	5.52	1.16	0.873	227	5.42	1.24	0.877

Note. *n* = number of cases. *M* = mean. *SD* = standard deviation. *α* = Cronbach's alpha.

[a] Index measure with 5 items. -105 = weak behavioral belief, 105 = strong behavioral belief. Q24 & 25.

[b] Index measure with 4 items. -84 = low normative belief, 84 = high normative belief. Injunctive Q30 & 31, Descriptive Q32 & 33.

[c] Index measure with 3 items. -63 = low control beliefs, 63 = high control beliefs. Q 39 & 40.

[d] Composite measure with 8 items. 1 = negative attitude, 7 = positive attitude. Q23.

[e] Composite measure with 4 items. 1= norms not promoting mitigation, 7 = norms promoting mitigation. Q 26-29.

[f] Composite measure with 5 items. 1 = perceived many constraints, 7 = perceived no constraints. Q34-38.

[g] Index measure with 7 items. 0 = no intentions/actions, 1 = intention/action to mitigate all. Q 22.

[h] Index measure with 5 items. 0 = no intentions/actions, 1 = intention/action to mitigate all. Q21.

[i] Composite measure with 6 items, 1 = no perceived risk, 7 = high perceived risk. Q 13-18.

[j] Index measure with 7 items. 0 = no experience, 1=much experience. Q12.

[k] Composite measure with 3 items. 1 = low level of knowledge, 7 = high level of knowledge. Q 9-11.

[l] Composite measure with 7 items. 1 = low sense of responsibility, 7 = high sense of responsibility. Q19.

Correlations of study measures are presented in Table 18 for the HOA sample and Table 19 for the non-HOA samples. To prepare data for analysis, a z-transformation was completed for each measure. This process centers and rescales the measures so the mean

is zero and standard deviation is one. Because of the widely variant range of the different measures, this process provided comparable scores across the measures for the analysis (Cohen, Cohen, West, & Aiken, 2003).

Table 18

HOA Variable Correlations

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Behavior Belief	1.00													
Injunctive Belief	0.49**	1.00												
Descriptive Belief	0.56**	0.74**	1.00											
Control Belief	0.37**	0.41**	0.47**	1.00										
Attitude	0.66**	0.43**	0.45**	0.33**	1.00									
Subjective Norms	0.62**	0.68**	0.63**	0.45**	0.56**	1.00								
Behavioral Control	0.37**	0.38**	0.51**	0.43**	0.32**	0.43**	1.00							
Maint. Intention	0.17**	0.20**	0.20**	0.15**	0.23**	0.16**	0.06	1.00						
Const. Intention	0.14*	0.16*	0.11	0.03	0.17**	0.16**	0.07	0.40**	1.00					
Maint. Action	0.24**	0.32**	0.34**	0.31**	0.28**	0.32**	0.28**	0.48**	0.28**	1.00				
Const. Action	0.14*	0.14*	0.21**	0.10	0.11	0.17**	0.14*	0.23**	0.40**	0.48**	1.00			
Risk	0.34**	0.27**	0.22**	0.20**	0.39**	0.35**	0.06	0.22**	0.12	0.31**	0.14*	1.00		
Experience	0.05	0.06	0.03	0.11	0.07	-0.05	-0.01	-0.08	0.13	0.16*	0.09	0.19**	1.00	
Knowledge	0.52**	0.44**	0.49**	0.29**	0.52**	0.50**	0.33**	0.24**	0.14*	0.35**	0.13*	0.47**	0.04	1.00
Responsibility	0.32**	0.40**	0.47**	0.10	0.32**	0.29**	0.15*	0.15*	0.16*	0.22**	0.10	-0.14*	-0.06	0.27**

Note. * $p < .05$. ** $p < .01$.

Table 19

Non-HOA Variable Correlations

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Behavior Belief	1.00													
Injunctive Belief	0.38**	1.00												
Descriptive Belief	0.50**	0.61**	1.00											
Control Belief	0.31**	0.25**	0.27**	1.00										
Attitude	0.65**	0.27**	0.35**	0.20**	1.00									
Subjective Norms	0.62**	0.56**	0.59**	0.27**	0.55**	1.00								
Behavioral Control	0.26**	0.18**	0.32**	0.33**	0.19**	0.31**	1.00							
Maint. Intention	0.23**	0.34**	0.25**	0.14*	0.22**	0.28**	0.12*	1.00						
Const. Intention	0.20**	0.23**	0.31**	0.09	0.17**	0.26**	0.13*	0.38**	1.00					
Maint. Action	0.29**	0.30**	0.29**	0.16**	0.27**	0.34**	0.19**	0.59**	0.25**	1.00				
Const. Action	0.21*	0.28**	0.29**	0.12*	0.20**	0.26**	0.18**	0.35**	0.33**	0.60**	1.00			
Risk	0.35**	0.27**	0.23**	0.12*	0.32**	0.29**	-0.07	0.27**	0.20**	0.29**	0.30*	1.00		
Experience	-0.03	0.03	0.05	-0.04	-0.01	-0.03	0.02	-0.07	0.02	0.10*	0.21	0.09	1.00	
Knowledge	0.40**	0.32**	0.39**	0.16**	0.36**	0.43**	0.10	0.29**	0.18**	0.32**	0.23*	0.58**	0.07	1.00
Responsibility	0.15**	0.01	0.19*	0.14	0.10	0.23**	-0.04	0.08	0.12	0.08	0.13	-0.19**	0.06	0.24**

Note. * $p < .05$. ** $p < .01$.

Model Results

Hypothesis 1 Test of Theory of Planned Behavior

The first general research question was to test the theory of planned behavior as a valid predictive model for the assessment of homeowner wildfire mitigation behaviors. A series of hypotheses were posed to address the general research question (Figure 4). A multi-group path analysis was used to test this question and hypotheses. Figure 7 presents the tested path model with composite measure reliability correction and intention and action measures split between maintenance actions and construction actions.

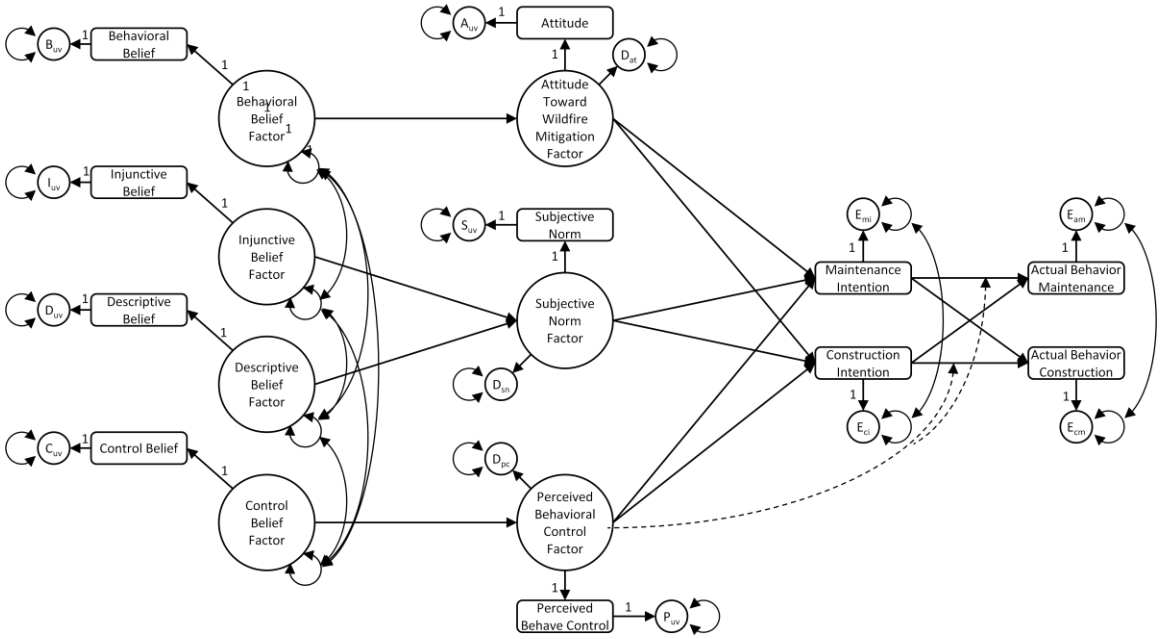


Figure 7 Hypothesis 1 Path Analysis Model

An initial multi group path analysis was completed. The overall model had poor fit to the data. The Chi square was significant ($x^2_{(56)} = 187.598$, $p < 0.001$) which identifies the model does not perfectly fit these data. The CFI identified good fit but the other fit indices identified rejection of the model (CFI = 0.968, SRMR = 0.185, RMSEA

= 0.102, CI [0.086, 0.119]). Modification indices were explored for possible paths which could be relaxed to improve model fit. However, without compromising the testing of TPB, the modification indices did not present any logical respecification. Due to the lack of fit, the model specific hypotheses cannot be tested. This suggests that TPB may not be a valid theoretical model to use in explaining wildfire mitigation behaviors. However, other issues could also be impacting the model's fit such as negatively worded items omitted from composite measures, or perhaps mitigation behaviors require a different causal structure.

Hypothesis 2 Test of WMB

Though the initial TPB model did not provide adequate fit to these data, the WMB model identified in the second research question was explored to see if model fit was improved. The second research question explored the WMB's validity as a predictive model that fit the data better than the initial TPB model (Figure 5). Figure 8 presents the path analysis model used to assess this question and associated hypotheses. This model also employs a reliability correction for the composite measures to take into account measurement error.

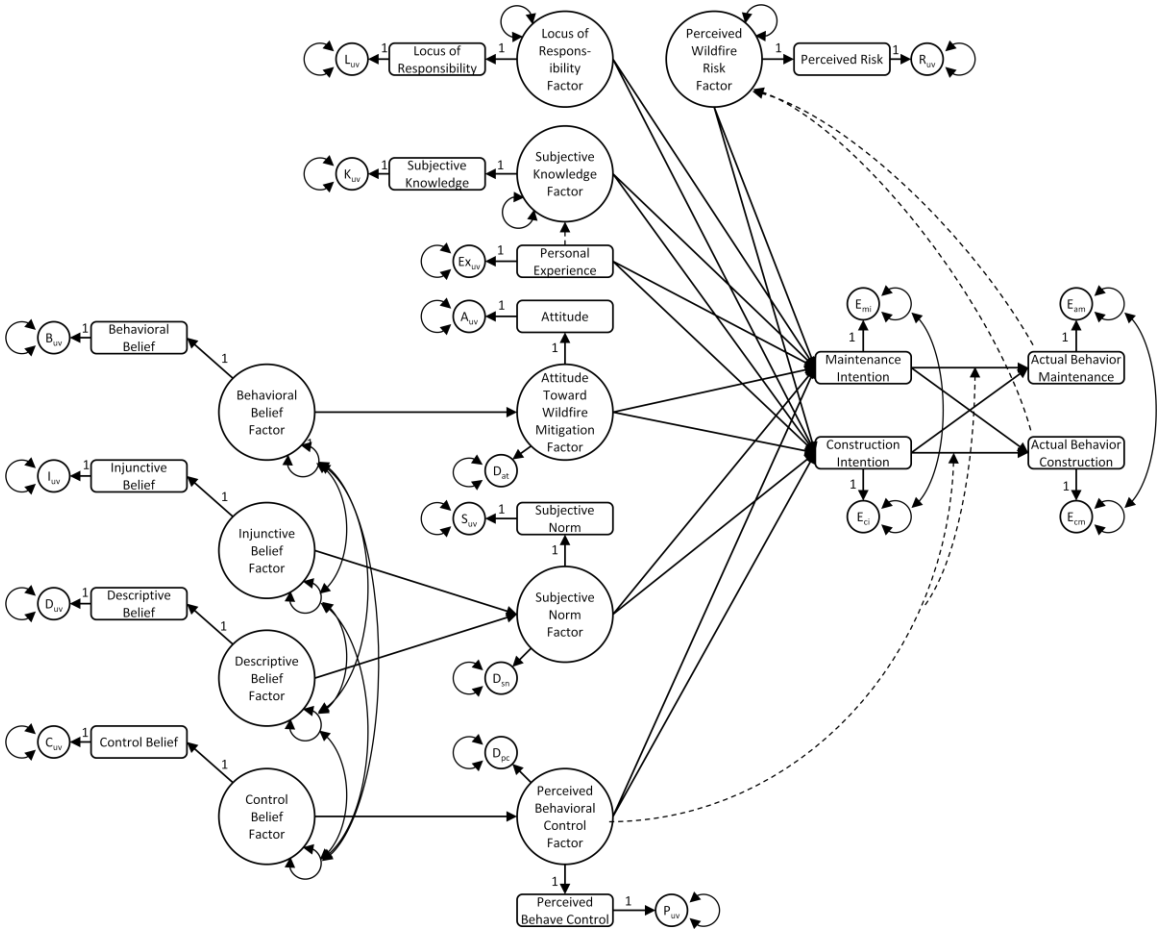


Figure 8 Hypothesis 2 Path Analysis Model

The multi group WMB model was tested and had poor fit to these data ($x^2_{(110)}$=1,389.625, $p < .001$, RMSEA = 0.242 CI [0.231,0.254], CFI = 0.755, SRMR = 0.171). Modification indices were explored but model respecification did not provide adequate model fit improvements. Question two and the subsequent hypotheses were unable to be explored. This suggests that the WMB is not a valid model for explaining wildfire mitigation behaviors.

Hypothesis 3 Test of WMB Perceived Wildfire Risk Moderation

Research question three seeks to identify whether perceived wildfire risk mediates the relationship between model predictors and intention to mitigate. Hypothesis 3 stated that perceived wildfire risk will have a significant indirect effect on the relationships between model factors of personal experience, subjective knowledge, locus of responsibility, attitude toward wildfire mitigation, subjective norm, and perceived behavioral control and intention to mitigate (Figure 6). Due to the poor model fit of the TPB and WMB models, this question and hypothesis were not tested.

Hypothesis 4 Test of HOA and Non-HOA Invariance

The final research questions asked if HOA membership significantly influenced homeowner mitigation behaviors. Hypothesis 4 stated that mitigation behaviors in a neighborhood with an HOA will be significantly different than homeowners in neighborhoods that do not have an HOA.

Due to the lack of fit of the TPB and WMB models, the invariance test could not be assessed. However, in exploring the differences between the HOA and Non-HOA samples, a MANOVA was conducted to identify potential mean differences. The one-way MANOVA explored the effect of HOA on model composite measures. A significant effect was identified ($F_{(15,619)} = 0.882$, $p < 0.001$). The individual ANOVA indicated that many measures had significantly different means between the two samples (Table 20). HOAs were found to significantly increase residents' attitude toward wildfire mitigation ($F_{(1,633)} = 5.411$, $p < 0.05$), subjective norm ($F_{(1,633)} = 13.607$, $p < 0.05$), injunctive belief ($F_{(1,633)} = 22.300$, $p < 0.05$), descriptive belief ($F_{(1,633)} = 37.389$, $p < 0.05$), perceived

behavioral control ($F_{(1,633)} = 9.160$, $p < 0.05$), subjective knowledge ($F_{(1,633)} = 8.417$, $p < 0.05$), perceived wildfire risk ($F_{(1,633)} = 7.024$, $p < 0.05$), intention to mitigate (maintenance, $F_{(1,633)} = 30.233$, $p < 0.05$ and construction, $F_{(1,633)} = 4.833$, $p < 0.05$), and mitigate actions (maintenance, $F_{(1,633)} = 38.587$, $p < 0.05$ and construction, $F_{(1,633)} = 5.721$, $p < 0.05$). These results suggest that HOAs influence mitigation behaviors.

Table 20

ANOVA Results for HOA differences

	Adjusted R^2	*F*	*p*
Behavioral Belief	0.002	2.365	0.125
Injunctive Belief	0.033	22.300	0.000
Descriptive Belief	0.054	37.389	0.000
Control Belief	0.001	1.785	0.182
Attitudes	0.007	5.411	0.020
Subjective Norm	0.019	13.341	0.000
Behavioral Control	0.013	9.160	0.003
Subjective Knowledge	0.012	8.417	0.004
Locus of Responsibility	0.002	0.026	0.873
Personal Experience	0.003	2.687	0.102
Perceived Wildfire Risk	0.009	7.024	0.008
Mitigate Intention (maintenance)	0.044	30.233	0.000
Mitigate Intention (construction)	0.006	4.833	0.028
Mitigate Action (Maintenance)	0.056	38.587	0.000
Mitigate Action (construction)	0.007	5.721	0.017

Note. Degrees of Freedom = 1, 633.

Extended Analysis

TPB has traditionally been studied through a regression or path model analysis (Finigan-Carr, Cheng, Gielen, Haynie, & Simons-Morton, 2014; Kasprzyk & Montano, 1998; Montano, Kasprzyk, Hamilton, Tshimanga, & Gorn, 2014; Painter et al., 2010). However, there is a growing base of literature that has utilized Structural Equation Modeling (SEM) analysis in assessing the TPB constructs (Bates et al., 2009; Cheng et al., 2006; Rah et al., 2004). In light of the TPB and WMB path model fit issues, these

data were further explored in a full SEM analysis. The following reports the results of this analysis

TPB Measurement Models

Based on the items described earlier, measurement models were explored for each construct in the TPB and WMB models. Table 21 presents the model fit of each measurement model. The five item behavioral belief factor had a significant Chi square suggesting the model does not provide exact fit to the data. Modification indices identified a poor fit to the data with the CFI and RMSEA identifying model rejection. However, the SRMR does suggest good fit ($x^2_{(18)} = 108.397$, $p < 0.05$, CFI = 0.872, SRMR = 0.040, RMSEA = 0.129, CI [0.106,0.152]). Modification indices were reviewed. Only one significant modification was identified and made to the measurement model. A covariance was added between "reduces impacts" and "protect belongings." It was concluded that these two items shared a similar concept as reducing impacts of a wildfire would protect ones belongings. Change in the Chi square was significant ($\Delta x^2_{(2)} = 33.3458$, $p < 0.05$). The final measurement model had a good fit to the data ($x^2_{(16)} = 34.257$, $p < 0.05$, CFI = 0.974, SRMR = 0.029, RMSEA = 0.061, CI [0.033,0.090]).

The initial injunctive beliefs measurement model included four items and offered acceptable fit ($x^2_{(10)} = 28.988$, $p < 0.05$, CFI = 0.973, SRMR = 0.030, RMSEA = 0.081, CI [0.048,0.117]). The Chi square test of exact fit was significant, however, the CFI and SRMR were within the good fit cutoffs while the RMSEA suggested mediocre fit. The modification indices were explored and one covariance was identified, "Family's

thoughts" with "neighbor's thoughts," which was included in the model. A justification for the covariance is that close neighbors may be held in the same regard as family members. The change in the model Chi square was significant ($\Delta x^2_{(2)} = 25.6184$, $p < 0.05$). The final model showed good fit to the data with a non significant Chi square and indices well within the cutoffs for good fit ($x^2_{(8)} = 8.839$, $p = 0.356$, CFI = 0.999, SRMR = 0.024, RMSEA = 0.019, CI [0.000,0.073]).

The four item measurement model for descriptive belief initially suggested an acceptable fit to the data with a significant Chi square ($x^2_{(10)} = 36.201$, $p < 0.05$, CFI = 0.946, SRMR = 0.036, RMSEA = 0.095, CI [0.063,0.130]). The RMSEA was in the mediocre fit range and CFI suggested acceptable fit. The SRMR suggested good fit. Modification indices were explored and two significant covariances were identified as potential causes of model misfit. One covariance was "neighbor's actions" with "friend's action" and the other was "full-time resident's action" with "neighbor's actions." It was concluded that many neighbors are considered friends which would account for this connection. From interviews, comments on the questionnaire, and the average seasonality of the respondents, it was concluded that full-time residents could be synonymous with ones neighbors. Both covariances were included in the measurement model. The change in Chi square was significant ($\Delta x^2_{(4)} = 22.3654$, $p < 0.05$). The final measurement model showed good fit to the data with a significant Chi square and all fit indices indicating good fit ($x^2_{(6)} = 8.519$, $p = 0.203$, CFI = 0.995, SRMR = 0.027, RMSEA = 0.038, CI [0.000,0.091]).

The three item measurement model for control belief suggested a good fit to the data ($x^2_{(4)} = 7.510$, $p = 0.111$, CFI = 0.974, SRMR = 0.033, RMSEA = 0.054, CI [0.000,0.114]). The non significant Chi square suggests the model has exact fit to the data with all other fit indices identifying good fit. Because of the good initial fit no modifications to the measurement model were explored.

The eight item measurement model for attitude indicated poor fit to the data ($x^2_{(54)} = 216.822$, $p < 0.05$, CFI = 0.808, SRMR = 0.168, RMSEA = 0.099, CI [0.085,0.113]). The modification indices were reviewed for model misfit. Three significant covariances were added to the overall model and one to the HOA specific model. The overall model covariances added were "bad/good" with "harmful/beneficial," "useless/useful" with "foolish/wise," and "undesirable/desirable" with "punishing/rewarding." The HOA specific covariance added was "foolish/wise" with "worthless/valuable." The modification had a significant change in model Chi square ($\Delta x^2_{(7)} = 73.1669$, $p < 0.05$). The final model had a significant Chi square and the SRMR which identified model rejection. The CFI and RMSEA identified good fit to the data ($x^2_{(47)} = 74.216$, $p < 0.05$, CFI = 0.968, SRMR = 0.135, RMSEA = 0.043, CI [0.023,0.062]). It is concluded that the model provides acceptable fit.

The three item measurement model for subjective norms suggested a good fit to the data with a non significant Chi square and fit indices all identifying good fit ($x^2_{(4)} = 3.490$, $p = 0.479$, CFI = 1.000, SRMR = 0.033, RMSEA = 0.000, CI [0.000,0.081]). Because of the initial model's fit no modifications were explored.

The five item measurement model for subjective norms indicated good fit to the data ($x^2_{(18)} = 38.843$, $p < 0.05$, CFI = 0.973, SRMR = 0.070, RMSEA = 0.062, CI [0.035,0.089]). Though the CFI and SRMR identify good fit, the Chi square was significant and the RMSEA is in the acceptable cutoff. The modification indices were reviewed for possible model misfit. One significant covariance, "ability to complete" with "confident in completing," was identified and added to the non-HOA specific model. The modification had a significant change in model Chi square ($\Delta x^2_{(1)} = 7.9159$, $p < 0.05$) and provided a measurement model with good fit ($x^2_{(17)} = 29.669$, $p < 0.05$, CFI = 0.984, SRMR = 0.047, RMSEA = 0.050, CI [0.016,0.079]).

Table 21

Measurement Model Fit Indices

Measurement Model	x^2	*df*	CFI	SRMR	RMSEA	RMSEA CI (90%)
Behavioral Belief	34.257*	16	0.974	0.029	0.061	[0.033,0.090]
Injunctive Belief	8.839	8	0.999	0.024	0.019	[0.000,0.073]
Descriptive Belief	8.519	6	0.995	0.027	0.038	[0.000,0.091]
Control Belief	7.510	4	0.974	0.033	0.054	[0.000,0.114]
Attitude	74.216*	47	0.968	0.135	0.043	[0.023,0.062]
Subjective Norm	3.490	4	1.000	0.033	0.000	[0.000,0.081]
Perceived Control	29.669*	17	0.984	0.047	0.050	[0.016,0.079]

Note. x^2 = Chi Square ($p<.05$). *Df* = Degrees of Freedom. CFI = Comparative Fit Index (>.95). SRMS = Standardized Root Mean Square Residual (<.08). RMSEA = Root Mean Square Error of Approximation (<.06). CI = Confidence Interval.

* $p < 0.05$.

These measurement models were analyzed in a full structural model to test TPB as identified in research question one. Figure 9 represents the model tested. The initial model had acceptable fit to the data ($x^2_{(1196)} = 2163.915$, $p < 0.05$, CFI = 0.920, SRMR = 0.082, RMSEA = 0.050, CI [0.047,0.054]). The Chi square was significant and the CFI suggested an adequate fit to the data. SRMR was outside the cutoff for good fit.

Modification indices were explored for areas of model misfit. Four significant covariances were identified and included in the final model estimation. A number of covariances were identified with the normative belief items suggesting relationships across the injunctive and descriptive factors. These covariances were "neighbor's actions" with "neighbor's thoughts" and "family's actions" with "family's thoughts." Two covariance paths were added to the descriptive beliefs factor items, "full-time resident's actions" with "family's thoughts" and "family's actions" with "friend's actions." The Chi square difference between the initial and final models was significant ($\Delta x^2_{(8)} = 118.7316$, $p < 0.05$). The final model still had a significant Chi square but presented improved SRMR and RMSEA which both identified good fit. The CFI was within the cutoff for acceptable fit ($x^2_{(1186)} = 1909.291$, $p < 0.05$, CFI = 0.940, SRMR = 0.069, RMSEA = 0.044, CI [0.040,0.047]). Overall, the final model provided good fit to the data.

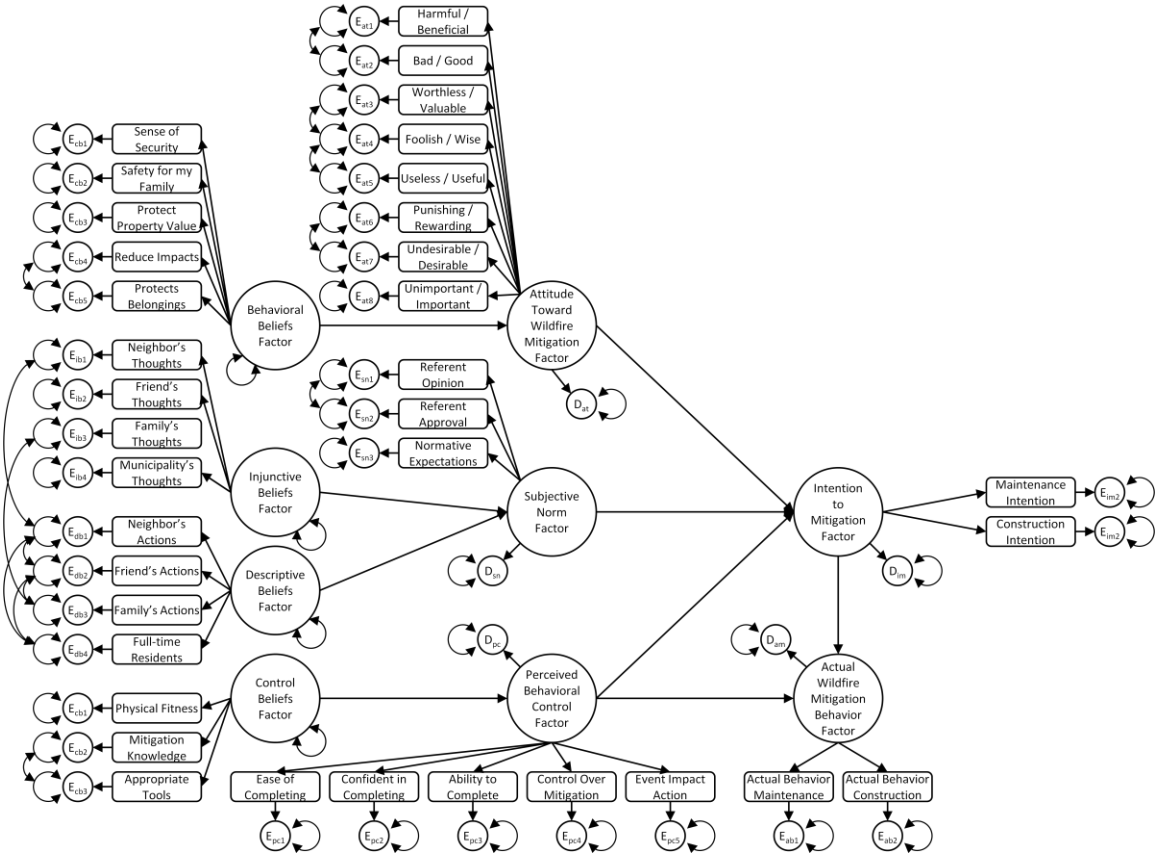


Figure 9 Hypothesis 1 Structural Equation Model

All factor loadings were significant and aided to the measurement of each factor suggesting good local fit to the data (Table 22 & 23). Table 24 presents the model estimates for each structural path and covariance. Hypotheses 1a was mostly supported (figures 10 and 11). The indirect to direct factor paths were all positive and significant accept for the path between injunctive belief and subjective norms for both HOA and non-HOA samples which was not a significant predictor of subjective norms. The behavioral belief factor had a positive and significant path to the attitudes factor (HOA, $\beta = 0.705$, $p < 0.05$ & non-HOA, $\beta = 0.685$, $p < 0.05$). Injunctive beliefs did not have a significant path to subjective norms for either sample. Both the HOA and non-HOA

samples had a significant and positive path from descriptive belief to subjective norm (β = 0.666, $p < 0.05$ & β = 1.087, $p < 0.05$, respectively). It is noted that the non-HOA standardized path coefficient of 1.087 is out of bounds with a value over one. The two factors have a high correlation (r = 0.848) which could present a case of multicollinearity between the factors. Finally, control beliefs provided a significant and positive path to perceived behavioral control for both samples (HOA, β = 0.689, $p < 0.05$ & non-HOA, β = 0.480, $p < 0.05$).

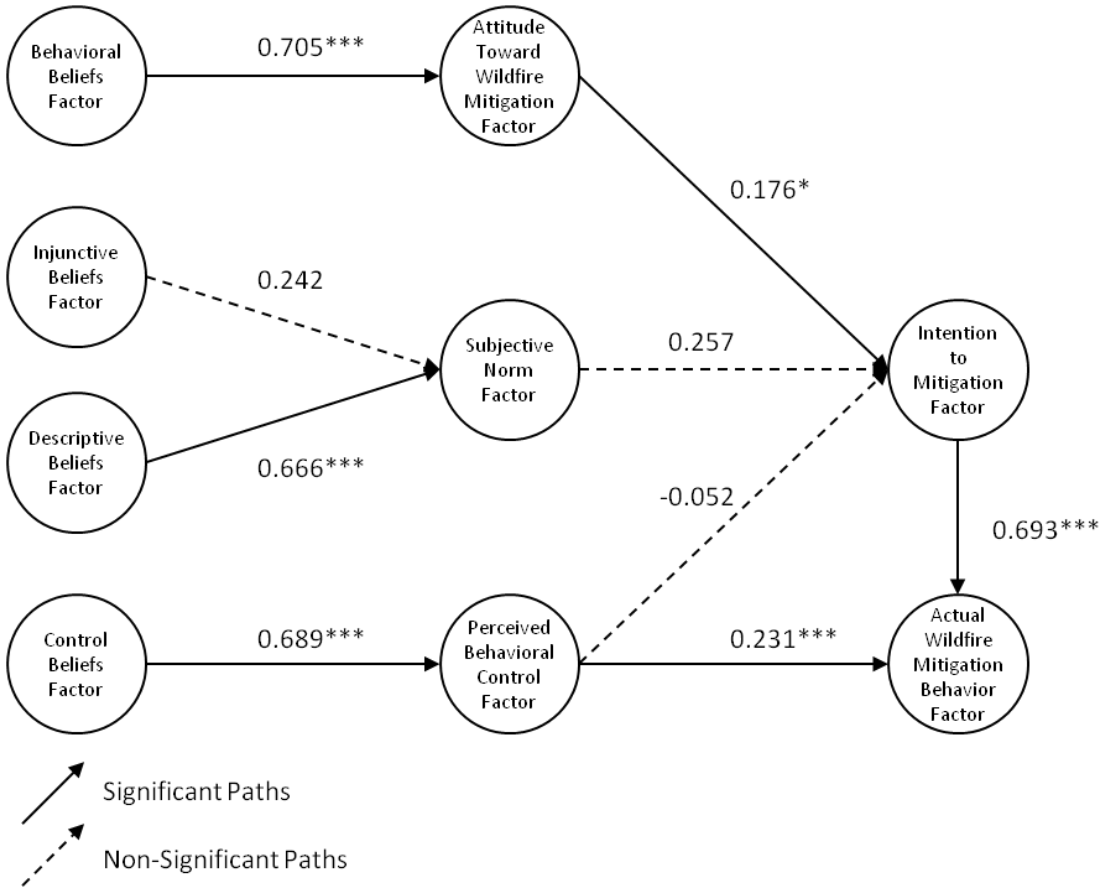


Figure 10. Hypothesis 1 HOA Model Paths
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

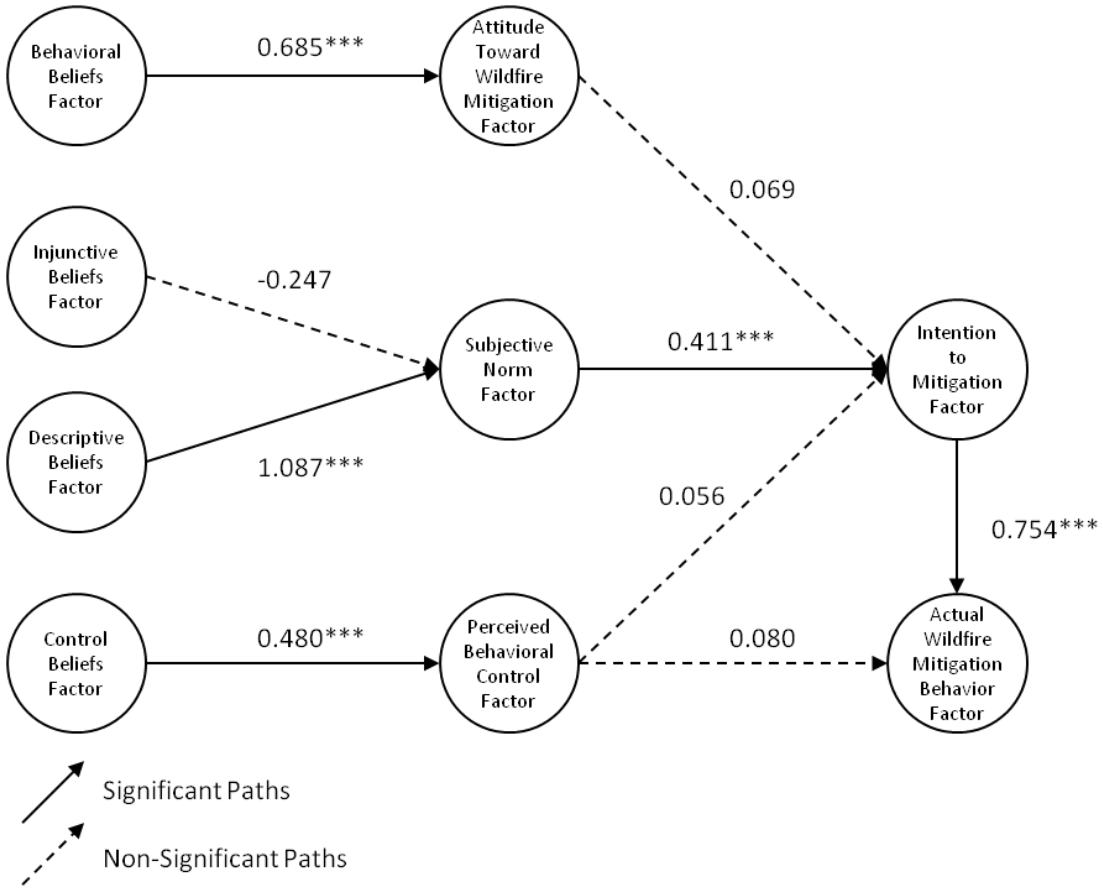


Figure 11. Hypothesis 1 Non-HOA Model Paths
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Predictors of intention to mitigate were different for each sample and partially supported hypothesis 1b. The model presented attitudes as a positive and significant predictor of intention to mitigate wildfire risk for the HOA sample ($\beta = 0.176$, $p < 0.05$). For the non-HOA sample, a positive and significant relationship was identified between subjective norms and intention to mitigate wildfire risk. The other predictors were not significantly related to intentions to mitigate wildfire risk. Hypothesis 1c was supported with intention to mitigate wildfire risk having a positive and significant relationship with actual wildfire mitigation behavior for both HOA and non-HOA samples ($\beta = 0.639$, $p < 0.05$ & $\beta = 0.754$, $p < 0.05$ respectively). In exploring hypothesis 1d, the moderation of

perceived behavioral control on the path between intention to mitigate wildfire risk and actual mitigation actions, the analysis did not suggest any interaction present not supporting the hypothesis. However, a significant path was identified from perceived behavioral control directly to actual wildfire mitigation behavior for the HOA sample (β = 0.321, $p < 0.05$).

Table 22

Hypothesis 1 Indirect Model Factor Loadings

	Model		HOA	Non-HOA
Parameters	b	SE	β	β
Behavioral Belief				
Sense of security	1.000	0.000	0.873***	0.892***
Safety for my family	0.940***	0.023	0.940***	0.894***
Protect property value	0.979***	0.030	0.900***	0.871***
Protects belongings	1.000***	0.036	0.849***	0.799***
Improves appearance	0.972***	0.032	0.853***	0.838***
Injunctive Norm				
Neighbor's thoughts	1.000	0.000	0.903***	0.944***
Friend's thoughts	1.008***	0.027	0.916***	0.953***
Family's thoughts	1.131***	0.036	0.897***	0.923***
Municipality's thoughts	0.848***	0.032	0.699***	0.695***
Descriptive Norm				
Neighbor's actions	1.000	0.000	0.670***	0.525***
Friend's actions	1.210***	0.059	0.800***	0.653***
Family's actions	1.494***	0.093	0.876***	0.650***
Full-time resident's actions	1.050***	0.065	0.693***	0.547***
Control Belief				
Physical fitness	1.000	0.000	0.553***	0.618***
Mitigation knowledge	1.293***	0.118	0.739***	0.748***
Appropriate tools	1.002***	0.103	0.523***	0.567***

Note. b = Unstandardized Bata coefficient estimate. β = Standardized Bata coefficient estimate. *SE* = Standard Error.

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 23

Hypothesis 1 Direct Model Factor Loadings

	Model		HOA	Non-HOA
Parameters	b	SE	β	β
Attitude Toward Mitigation				
Harmful/Beneficial	1.000	0.000	0.888***	0.819***
Bad/Good	1.187***	0.079	0.902***	0.858***
Worthless/Valuable	1.356***	0.091	0.869***	0.920***
Foolish/Wise	1.317***	0.101	0.857***	0.850***
Useless/Useful	1.320***	0.093	0.854***	0.857***
Punishing/Rewarding	1.277***	0.094	0.645***	0.712***
Undesirable/Desirable	1.366***	0.095	0.718***	0.801***
Unimportant/Important	1.331***	0.095	0.900***	0.879***
Subjective Norm				
Referent opinion	1.000	0.000	0.815***	0.753***
Referent approval	0.787***	0.041	0.762***	0.712***
Normative expectations	0.835***	0.074	0.593***	0.613***
Perceived Behavioral Control				
Ease of completing	1.000	0.000	0.719***	0.734***
Confident in completing	1.113***	0.062	0.902***	0.866***
Ability to complete	1.060***	0.055	0.923***	0.860***
Control over mitigation	1.020***	0.063	0.756***	0.820***
Event impacting action	0.927***	0.064	0.630***	0.670***
Intention to Mitigate				
Intention to mitigate maintenance	1.000	0.000	0.783***	0.786***
Intention to mitigate construction	0.498***	0.065	0.444***	0.473***
Mitigation Action				
Mitigation action maintenance	1.000	0.000	0.928***	0.946***
Mitigation action construction	0.494***	0.052	0.512***	0.623***

Note. b = Unstandardized Bata coefficient estimate. β = Standardized Bata coefficient estimate. *SE* = Standard Error.

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 24

Hypothesis 1 Model Estimates

	HOA		Non-HOA	
Parameter	β	*SE*	β	*SE*
Behavioral Belief → Attitude	0.705***	0.037	0.685***	0.054
Injunctive Belief → Subjective Norm	0.242	0.172	-0.247	0.302
Descriptive Belief → Subjective Norm	0.666***	0.156	1.087***	0.257
Control Belief → Perceived Control	0.689***	0.051	0.480***	0.075
Attitude → Intention to Mitigate	0.176*	0.080	0.069	0.074
Subjective Norm → Int. to Mitigate	0.257	0.133	0.411***	0.084
Perceived Control → Int. to Mitigate	-0.052	0.095	0.056	0.075
Int. to Mitigate → Mitigate Action	0.639***	0.101	0.754***	0.075
Perceived Control → Mitigate Action	0.231***	0.065	0.080	0.055
Inj. Belief ↔ Behavioral Belief	0.500***	0.057	0.406***	0.053
Desc. Belief ↔ Behavioral Belief	0.698***	0.050	0.741***	0.047
Desc. Belief ↔ Inj. Belief	0.751***	0.061	0.835***	0.079
Control Belief ↔ Behavioral Belief	0.515***	0.067	0.457***	0.077
Control Belief ↔ Inj. Belief	0.503***	0.068	0.334***	0.083
Control Belief ↔ Desc. Belief	0.761***	0.058	0.467***	0.085
Protect belongings ↔ Reduce impact	0.447***	0.088	0.593***	0.074
Family thought ↔ Neighbor thought	-0.262	0.151	-0.386*	0.182
Neighbor action ↔ Friend action	0.505***	0.061	0.526***	0.094
Neighbor action ↔ Neighbor thought	0.435***	0.095	0.235**	0.090
Full-time res. act. ↔ Neighbor action	0.362***	0.071	0.533***	0.067
Full-time res. act. ↔ Friend action	0.376***	0.068	0.399***	0.091
Family action ↔ Family thought	0.560***	0.107	0.314***	0.090
Family action ↔ Friend action	0.198**	0.067	0.425***	0.095
Undesirable/Desirable ↔ Punishing/Rewarding	0.305**	0.100	0.340**	0.123
Useless/Useful ↔ Foolish/Wise	0.202	0.133	0.796***	0.093
Bad/Good ↔ Harmful/Beneficial	0.302*	0.153	0.176	0.234
Foolish/Wise ↔ Worthless/Valuable	0.531*	0.235	0.361***	0.114

Note. β = Standardized Bata coefficient estimate. *SE* = Standard Error.
*$p < .05$. **$p < .01$. ***$p < .001$.

DISCUSSION

This study investigated the application of TPB in a homeowner wildfire mitigation context to provide unique insight into mitigation behaviors. This adds to the growing literature on the use of TPB in a wildfire mitigation context. An integrative wildfire mitigation model was proposed as an encompassing analysis of the antecedents that explain mitigation actions. A novel exploration of the present empirical study was the difference between HOAs and non-HOAs on resident wildfire mitigation actions. This contributes to the gaps in the literature which has not directly studied these dynamics.

The current study conducted key informant interviews to explore the relevant study location factors concerning homeowner wildfire mitigation behaviors. These interviews were conducted in large part to develop valid scales for the questionnaire but also to gain a firsthand understanding of the community this dissertation studied. The main portion of this study was the development and testing of the TPB and WMB models and exploring the differences between factors that influence wildfire mitigation behaviors among HOA and non-HOA residents. This discussion will fold the findings from both the interviews and questionnaire responses into a comprehensive review of the results.

Model Performance

The study tested three path analysis models looking at the use of TPB and its validity in explaining homeowner wildfire mitigation behaviors, validity of the developed WMB model which takes TPB and adds salient wildfire mitigation factors, and mediation of perceived risk in the explanation of mitigation behaviors. The goal was to identify the

best fitting model and conduct an invariance test to explore the differences among homeowners living in an HOA and those who are not. The multi-group path analysis did not provide adequate model fit to these data; therefore the hypotheses could not be addressed as the standard errors and effects could be biased. Modification indices, which identify constrained paths that are leading to model misfit, identified only paths that would impact the theory's core structure. The lack of fit suggests that TPB may not be the correct model to assess mitigation behaviors. However, there could be other possibilities leading to this misfit. First, though composite measures were created based on Fishbein and Ajzen's (2010) outlined methods, there could be some concerns with the composite measure being this is a new area of study for TPB. These concerns are discussed in the following section on methods. Second, in a wildfire mitigation context, the TPB internal factors may take on a different structure. This was concluded by Bates et al. (2009) where the authors identified perceived behavioral control as a mediator between attitude and subjective norms relationship with behavioral intentions.

This study took a more traditional approach to the theory analysis as outlined by Fishbein and Ajzen (2010). Many researchers have used and continue to use these regression and path analysis approaches in the study of TPB (Finigan-Carr et al., 2014; Kasprzyk & Montano, 1998; Montano et al., 2014; Painter et al., 2010). The test of TPB in a multi-group path analysis was unsuccessful. Though limited research has assessed wildfire mitigation quantitatively in a TPB structural context, literature has shown its potential (Bates et al., 2009; Vogt et al., 2005; Winter et al., 2009; Winter et al., 2002).

Research has also used a fully latent structural regression model, a type of structural equation model (SEM), as a tool for the analysis of TPB direct factor relationships (Bates et al., 2009; Cheng et al., 2006; Rah et al., 2004). Advantages of implementing a latent structure is the development of each measurement model, also defined as a confirmatory factor analysis (CFA) (Kline, 2011), that allows for a better understanding of the role each variable has in predicting the latent factor.

In light of the TPB and WMB path model fit issues, these data were further explored in a fully latent structural model. Though not part of the original proposal; this analysis was used to continue the exploration of TPB's validity as a framework to explain homeowner wildfire mitigation behaviors as well as to explore why the path models did not fit the data. Through a fully latent SEM, TPB was shown to be a valid theoretical model in understanding mitigation behaviors. This is different from Bates et al.'s (2009) study which identified a modified TPB structure. The SEM model identified unique predictors of intentions to mitigate wildfire risk for each sample (HOA & non-HOA). This is a novel finding as previous literature has not explored HOA and non-HOA empirically in a wildfire mitigation context. In addition, TPB's full structure, including indirect, direct, intentions, and actual behaviors has not been assessed in a wildfire mitigation context. This is a gap in the literature addressed by this study.

Though research question one and its hypotheses were tested, research questions two, three, and four were not tested as the dissertation was focused on the analysis of TPB through a path analysis and not a fully latent SEM. The exploration of SEM was to test TPB as a valid theory to use in a wildfire mitigation context and to outline the

continued analysis of these data through a fully latent SEM. Giving these results, Full latent SEM is suggested for future analysis of TPB when studying wildfire mitigation behaviors.

In testing the fully latent TPB model, perceived behavioral control was explored for the theorized interaction of intention's influence on actual behavior. This interaction was not found but a direct connection to the actual mitigation behavior factor was identified. Fishbein and Ajzen (2010) noted this interaction is often not significant and is why many researchers assess perceived behavioral control's direct effect on behavior instead. However, Fishbein and Ajzen explained perceived behavioral control does not always have this direct relationship. For instance, a lack of control to perform the behavior will likely limit actual behavior. However, a high level of control just states that a person can perform the action, in which case it is the individuals intentions that would be predicting actual behavior while perceived behavioral control would moderate that relationship. With this in mind, an argument could be posed that in this context, because of the significant direct relationship; individuals in HOAs perceive a lack of control over performing mitigation behaviors.

Study findings raise some issues from a methodological perspective. As identified in the results, there were concerns with the composite measures of behavioral beliefs and control beliefs not fully addressing the breadth of each concept. In particular, the negatively worded items that were omitted in the final composite measure calculations could have left out important underlying concepts of the larger constructs. This may have led to the limited ability for the measure to describe the full construct

impacting model fit. For instance, the behavioral belief items addressing "significant cost of mitigation" and "mitigation will not stop home from burning" were removed due to their negatively worded stance. These items, dealing with financial impacts and effectiveness of mitigation could be important concepts not addressed in the measure.

Though the negatively worded items were recoded and assessed, two issues were presented. First is the effect of negatively worded items on participant responses. DiStefano and Motl (2006) identified effects based on wording of items and that negatively worded items could be estimated as a distinct latent variable. This suggests negatively worded items are assessing a different personality characteristic. In other words, negatively worded item responses are different than positive items and are measuring a slightly different concept largely based on individual personality. Second, inconsistent responses were identified with the negatively worded items. This was largely due to respondents not reading each item carefully and providing an appropriate response. Instead some respondents provided the same response to both positive and negative worded items suggesting that each item was not carefully read and comprehended. Concerns with this issue and comprehension of the positive and negative worded items have been identified in the literature (Marsh, 1984; Weems, Onwuegbuzie, & Collins, 2006; Williams & Swanson, 2001).

In addition, perhaps there are other concepts that were not addressed in the questionnaire. Interviews and a pilot study were conducted to identify and validate the items identified by the community. Though other community specific items may have not been addressed as both the interviews and pilot study only sampled a small subset of

the population. The omission of these unknown community specific items could also have had an impact on the measure's ability to address the full concepts needed in the models.

Besides methodological implications, study findings offer other insights based on presence of an HOA. The fully latent SEM model provided good fit to these data and offered insight into differences between predictors of intentions between HOAs and non-HOAs. These findings provide the first empirical evidence that HOAs impact homeowner wildfire mitigation behaviors uniquely when compared to homeowners in non-HOAs. The role HOAs have on resident mitigation behaviors have been qualitatively explored by McCaffrey et al. (2011) and Monroe et al. (2013). Not only do the findings address gaps in the literature, they emphasize the importance of continued exploration of HOAs in a wildfire mitigation context.

HOA

For the HOA sample, attitudes provided a significant prediction of intentions. This was consistent with Bates et al. (2009) study which showed that attitude was a significant predictor in their study exploring knowledge and its impact on behavior through attitudes, subjective norms, and perceived behavioral control. Though findings were consistent, there are two significant deviations from Bates et al.'s study. First, the Bates et al.'s study suggested a different structure to the model which was not identified in the analysis of this dissertation's data. Bates et al.'s use of a different structure could have been chance characteristic of the sample and is ultimately testing different assumptions than theorized with TPB. Findings of the current study show that the theory

provided a good structure in explaining wildfire mitigation behaviors. Second, the current study finding is specific to HOAs which was not a population specifically studied by Bates et al. (2009).

The finding also aligned with Vogt et al. (2005) study looking at acceptance of fuel management approaches. Their study sampled a much broader population looking at three separate locations or cases offering more wildfire aware communities, specifically California and Florida. The study asked about acceptance of mechanical treatment in a TRA approach. Though the context is slightly different than that of this current study, the general attitude toward wildfire risk reductions are complementary.

This finding shows that residents with positive attitudes toward wildfire mitigation actions tend to have high behavioral intentions for completing these actions on their property. This also means that residents with a poor attitude with have low intentions for taking action to mitigate their property. This finding presents a unique understanding of mitigation intentions within HOAs.

Not consistent with Bates et al. (2009) study that showed subjective norms as a significant predictor of intentions, subjective norm in this current study was not a significant predictor of behavioral intentions. Sisser et al. (2016) in a study looking at lawn maintenance compliance in HOAs, identified that norms were a prevalent but not a driving force in awareness of ordinances. Though awareness is a different context than intention to behave, Sisser et al. note that there could be differences based on the strength of norms in different neighborhoods that may influence its impact. Norms in a wildfire mitigation context could vary within HOAs based on a number of factors such as

association regulations and their level of enforcement. In other words, social norms may not be a significant predictor of intentions due to the dynamic within HOAs relating to mitigation focused CC&R's as well as enforcement of these regulations. There can be a range of week to strong and lenient to strict HOAs which could be moderating subjective norms relationship with intention to mitigate.

In contrast to Bates et al. (2009) which identified perceived behavioral control as a positive and significant predictor of intentions, this relationship was not significant among the HOA sample. Instead, as described above, perceive behavioral control had a positive and significant direct relationship with actual mitigation actions. This relationship was not found in the previous study. This suggests that residents' with perceived control over their ability to complete mitigation actions are likely to mitigate within HOA neighborhoods. In other words, a residents' perceived lack of control over their ability to mitigate may supersede their strong intentions toward mitigation which could lead to no mitigation behaviors attempted.

The multi-group SEM analysis has provided these significant factors in the understanding of wildfire mitigation in HOAs. Exploring the non-HOA sample identifies significant relationships that are different than the HOAsample. The following section will discuss these unique non-HOA predictors of intention to mitigate.

Non-HOA

Exploring TPB model results for the non-HOA sample, the main driver of intentions to mitigate wildfire risk was subjective norms. This was consistent with Bates et al. (2009) findings who also reported a positive and significant relationship between

subjective norm and intention. Much literature has identified the relevance norms have on actions, and in this case intentions, to mitigate property (Brenkert-Smith et al., 2006, 2012; Brenkert-Smith et al., 2013; Monroe et al., 2013). Social networks, which provide avenues for knowledge exchange and formation of subjective norms, with neighbors, friends, or family was found to have a significant effect with regard to mitigation levels (Brenkert-Smith et al., 2012; Brenkert-Smith et al., 2013). Brenkert-Smith et al. (2006) in a qualitative study identified the importance of family in addressing wildfire mitigation. These studies help to understand subjective norm's importance in non-HOA neighborhoods. Specifically, when there is limited wildfire mitigation regulation and/or enforcement, neighborhoods rely on the social networks and what others are doing as cues of accepted behaviors. In other word, neighborhoods without an association still have informal social rules that influence mitigation. This research shows that even residents who do not want a neighborhood association and the dues that typically come with such a membership, are still influenced by and working with other residents.

Role of HOAs in Mitigation

HOA respondents showed higher average ratings of study factors overall than non-HOA. They tend to have more positive attitudes toward mitigation actions, stronger neighborhood norms and normative beliefs, a higher perceived control over ones actions, a higher level of subjective knowledge, higher level of perceived risk, higher intention to mitigate, and were more likely to take action. However, study analysis showed that maintenance mitigation intentions do not lead to as high of a ratio of actions taken as in a non-HOA situation. In other words, HOA respondents who intend to mitigate their

property tend to complet fewer actions relative to their intentions than their non-HOA counterparts.

These results are similar to the literature which has noted that HOAs play a large role in mitigation actions (Collins, 2008; Dickinson et al., 2015; Jakes et al., 2007; Nelson, Monroe, Johnson, & Bowers, 2003). It has been suggested that HOAs, more notably their board members, provide an information connection from agencies, governments, and councils to neighborhood residents (Dickinson et al., 2015; Jakes et al., 2007; Monroe et al., 2013; Nelson et al., 2003). Interview data highlighted these connections and how HOAs create awareness and educate residents of their risk and actions that can be taken. The literature identifies the importance of HOA meetings in creating awareness of risk and providing information on mitigation options to residents, including new and part-time residents who may not have access to this information in other settings (Dickinson et al., 2015; Jakes et al., 2007; Monroe et al., 2013; Nelson et al., 2003). The results show subjective knowledge was significantly higher among HOA than non-HOA respondents. Beyond the quantitative results, interviews provided a much broader glimpse into the role HOAs play in wildfire mitigation behaviors.

HOAs play and important role regarding access to resources. Interview data identified how government grants provide help to homeowners, specifically through providing financial support for mitigation work on private property. These grants are often contingent on the neighborhood taking actions as a whole. For example, the Firewise Communities program requires neighborhoods to have completed a wildfire risk assessment, an action plan, hold “Firewise Day” events annually, invest money into local

Firewise actions, and submit documentation to become a registered community (National Fire Protection Association, 2009). However, as an interview participant noted, neighborhoods "…need a champion to take on this task and promote firewise." HOAs, with their organized boards, and in some cases staff, provide a means to coordinate the processes of becoming firewise and complete paperwork required to apply for these grants. The concern is that residents in non-HOA neighborhoods or HOA neighborhoods not willing to take on the task of becoming Firewise, miss out on this financial support. Bringing this back to the sample demographics, non-HOA residents on average have lower income and have a higher percentage still in the workforce than their HOA counterparts. This suggests that non-HOA residents may actually be in higher need of financial support than those located in HOAs. Collins and Bolin (2009) framed a similar relationship in their study of the White Mountains in exploring people's negotiation of the wildfire risk. They noted that the "amenity migrants," or new residents moving to the WUI for the natural aspects, put the working class residents at a higher wildfire risk and that the focus should be on addressing "social vulnerability". Collins and Bolin (2009) define "social vulnerability" as a "Lack of financial, physical, and/or legal capacity to reduce risk" (p.441). The access to financial resources brought up by interview participants adds to this idea of social vulnerability with comments such as "…the other neighborhood have some retired folk that are not stable financially" and "I am concerned with unincorporated lots adjacent to our neighborhood."

Implications

Creating a resilient community requires everyone from homeowners to federal land management agencies to do their part in mitigating wildfire risk (Davis, 1990; Jakes et al., 2007; Winter et al., 2009). Passing and uniformly enforcing ordinances do create awareness and compliance of the adopted wildfire code (Haines, 2008; Sisser et al., 2016). However, it is difficult to pass such measures restricting homeowner property rights and freedom (Sisser et al., 2016; Vogt, Winter, & McCaffrey, 2007).

This study explored different aspects of mitigation behaviors to understand and identify unique ways in promoting homeowner wildfire mitigation actions. Through applying TPB to a wildfire mitigation context, underlying beliefs that are at the heart of an individual's decision to behave in a certain way can be identified (Fishbein & Ajzen, 2010). Addressing or changing these underlying beliefs will promote mitigation actions.

In HOAs, the driving factor of wildfire mitigation intention was attitudes toward mitigation behaviors. With this information, the focus on promoting homeowners to mitigate their property should center on changing underlying behavioral beliefs which predict attitudes. The behavioral beliefs assessed in this study included a sense of security, safety for family, protection of property value, reducing impacts from wildfire, and protection of personal belongings. These salient beliefs are framed by the individuals' belief that the event is likely to occur and their evaluations of the event's benefit. For instance, a homeowner may feel a sense of security is likely if they mitigated their property and a wildfire occurred (event is likely to occur). But they may also believe that a sense of security is good (evaluation of the event's benefit). This

would make their overall belief about mitigation providing a sense of security very high which impacts their overall attitude toward performing the action. In this case, outreach programs that provide information on how mitigation can increase security of the home would be one strategy to change behavioral beliefs. Each of the belief items identified should be addressed with outreach efforts espousing the benefits mitigation provides.

Perceived behavioral control was also a significant factor for the HOA respondents. This directly influenced actual mitigation behavior. As noted above, perceived constraints can limit actual behavior even if the individual has a positive attitude and there are strong normative pressure promoting the behavior. Exploring the beliefs associated with perceived behavioral control, knowledge of actions to take, having the appropriate tools, and physical fitness, provide insight into the constraints individuals may be facing when it comes to completing wildfire mitigation actions. Strategies for outreach are discussed later in this section but there is a clear need to create awareness of such services. There should be continued outreach to inform homeowners about actions they can take. As this study has identified, many older and retired individuals are living in the Prescott area. Some homeowners may not be in a physical condition to complete certain or any actions themselves. Connecting these individuals with information on contractors and municipal services is critical. By removing the obstacles homeowners face, they will be more likely to complete mitigation actions on their property.

In non-HOA neighborhoods, subjective norms provided a significant impact on intention to mitigate. Descriptive belief, which was significantly and positively related with subjective norms, identifies the impact an individual can have on another by

behaving in a certain way. In other words, the mitigation actions (or non actions) of neighbors, friends, family, and full-time residents create a social norm that people tend to adhere to (Fishbein & Ajzen, 2010). From a municipality or agency stand point, it is very important to lead by example and continue to mitigate fire prone property. This not only represents the municipality's or agency's commitment to community safety but can also set a social norm of the community itself. Another avenue would be to showcase mitigated property to promote this norm through media sources.

Connecting important information to the intended audience is not always an easy proposition. This takes numerous strategies and sources as well as a continued message (Winter & Cvetkovich, 2010). The following discusses potential strategies to address the messages identified above. One of the most impactful modes of delivering messages about wildfire mitigation is having an agency official visit the home. Though one of the more expensive and time consuming propositions, creating direct connections, an open dialog, and personal relationships with homeowners is a key element in gaining compliance (Jakes et al., 2007; Vogt et al., 2007; Winter & Cvetkovich, 2010). Though the "expert" is always desired, other sources could be community members of neighboring Firewise Communities who could talk with homeowners. Specifically in Prescott, PAWUIC is a major resource in the community and has connections to individuals who are passionate and knowledgeable about this issue. PAWUIC thus has an important role to play in education and outreach.

Media sources, such as newspapers, magazines, radio, and television are ideal for a continued year round message. Working with the local newspaper to print stories about

mitigation efforts and successes in areas where fires have impacted the WUI could help with improving those behavioral beliefs toward mitigation. A weekly "mitigation task" segment in the paper, local weekly magazine, on the radio, or on television could help with a continued message and provide one task to complete each week with information about the specific task, municipal services, and contractors who can aid. An annual prime time program on a national television station before wildfire season could also provide directed information to many in the Prescott area. This is a strategy often done in regions that are at risk of natural disaster such as Florida with its hurricanes and California with its potential for earthquakes. Pamphlets mailed to residents a few times a year can provide more detailed information on actions and resources available to the community. All of these suggestions work to disseminate messages that ultimately aim to change residents' beliefs toward mitigation actions.

Limitation of Results

It is important to understand the limitations of this study and applicability of results. As identified, this research studied a particular case and time. In particular, the Prescott area is a unique case in that the community in general has been very proactive about wildfire protection for many years. This is not indicative to most communities. These results could be quite different if implemented in another geographical context.

Studying the full gamut of wildfire mitigation behaviors may limit some of TPB's predictability. TPB has traditionally been used to study specific behaviors such as smoking and contraception use (Hanson, 1997; Kasprzyk & Montano, 1998; Marandu, 2009; Noonan et al., 2011; Terry et al., 1993). This study explored a full range of actions

that make up “wildfire mitigation actions.” Giving the uniqueness of many of these actions, TPB may have limited predictability because of this. This study segmented intentions and actions into two more relevant concepts, maintenance actions and construction actions, but this may still limit TPB’s prediction of mitigation behavior as each question used to predict intentions addressed “wildfire mitigation behaviors on property and home.” Ideally, each mitigation action would be individually addressed as outlined by this study. However, this was neither practical nor feasible giving the number of questions that would need to be asked.

Wildfire mitigation can be an emotionally charged topic. The study identified about six individuals with concerns that the results will create regulation imposed on them and their property. These individuals who contacted the researchers with this view refused to complete the questionnaire. Though it is felt that these data provide a good representation of the population, there is the potential of some viewpoint not being expressed as strongly in the results.

Future Research

This study continued the exploration of TPB as a tool to describe and predict wildfire mitigation behaviors of homeowners. The strength of the theory is its assessment of underlying beliefs that are at the core of attitudes, norms, and control of behavior. It was shown that through a fully latent SEM analysis, TPB proves to be a valid predictive model. Research on TPB’s applicability and the development of a large predictive model should continue to be explored and tested through a full latent SEM.

Another important area of research is the role HOAs play in wildfire mitigation in two regards. First, the role they play in the dissemination of wildfire information. This study highlighted these linkages through participant interviews but did not explicitly explore linkages empirically. Future research on this topic is important, especially in identifying avenues and strategies to more efficiently reach both homeowners in and not in an HOA. Second, is the understanding of HOA Covenants, Codes, and Restrictions in promoting or limiting wildfire mitigation actions. Exploring the wildfire specific regulation and enforcement within HOAs could provide a better understanding of the range of impacts HOAs can have in regard to mitigation actions. In other words, how does the strength of an HOA factor into the influence it has over mitigation behaviors.

In connection with the continued exploration of model development, the factor items need to be developed further in this wildfire context. As identified, the composite measures had some potential issues with items that were negatively worded. Research addressing these items in positive statements could provide better measures. Also, as this is a relatively new area of study for TPB it is important to explore additional items that could be included in the measurement of each factor.

Insurance companies are becoming a more prominent fixture in promoting wildfire mitigation action of homeowners. Many are now requiring properties in the WUI to be mitigated before a policy will be written. Others are promoting mitigation through incentives or discounts on premiums. Insurance companies' impacts on wildfire mitigation actions were evident in many of the interviews conducted. Their role is an important area that needs further study.

CONCLUSION

This dissertation explored the use of TPB in a wildfire mitigation behavioral context as well as the impacts HOAs have on this behavior. TPB was shown to be a valid theoretical model to help explain mitigation behaviors. Findings showed the influence of attitudes to be a driving force for the development of intentions to mitigate in neighborhoods with HOAs and that perceived behavioral controls directly impacted actual mitigation actions. While the main influence of intentions within non-HOAs neighborhoods were subjective norms.

Though the study intended to test the development of a Wildfire Mitigation Behavioral model, the proposed path analysis did not provide adequate fit to these data and thus the analysis could not be completed. TPB was assessed through a fully latent structural model which provided a good fitting model. Through the exploration of a MANOVA, HOAs were found to play a significant role in many aspects of wildfire mitigation.

Specific beliefs were identified that could be targeted in promoting wildfire mitigation action. In a time of limited budgets, these focal areas would provide the most impact with the limited resources at their disposal. This is more relevant in the current era where we are contending with a century of forest management creating a situation of unhealthy forests coupled with an increase in people moving to the WUI. With more money being funneled into suppression costs, limited resources are left to address proactive actions. This dissertation provided specific areas to focus these limited resources to help limit wildfire's impact on individuals and communities.

REFERENCES

Abamecha, F., Godesso, A., & Girma, E. (2013). Predicting intention to use voluntary HIV counseling and testing services among health professionals in Jimma, Ethiopia, using the theory of planned behavior. *J Multidiscip Healthc, 6*, 399-407. doi:10.2147/JMDH.S49339

Agarwal, V. (2014). A/H1N1 vaccine intentions in college students: an application of the theory of planned behavior. *J Am Coll Health, 62*(6), 416-424. doi:10.1080/07448481.2014.917650

Agee, J. K., & Skinner, C. N. (2005). Basic principles of forest fuel reduction treatments. *Forest Ecology and Management, 211*(1-2), 83-96. doi:10.1016/j.foreco.2005.01.034

Ajzen, I. (1988). *Attitudes, personality and behavior*. Milton Keynes: Open University Press.

Ajzen, I. (2005). *Attitudes, personality, and behavior*. New York, NY: McGraw-Hill International.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior* (Vol. Pbk). Englewood Cliffs, N.J.: Prentice-Hall.

Ajzen, I., & Fishbein, M. (2005). The influence of attitudes on behavior. *The handbook of attitudes*, 173-222.

Al-Suqri, M. N., & Al-Aufi, A. S. (2015). *Information seeking behavior and technology adoption : theories and trends*. Hershey, PA: Information Science Reference.

Aleassa, H., Pearson, J. M., & McClurg, S. (2011). Investigating Software Piracy in Jordan: An Extension of the Theory of Reasoned Action. *Journal of Business Ethics, 98*(4), 663-676. doi:10.1007/s10551-010-0645-4

The American Heritage Dictionary. (1985). (2nd college ed.). Boston: Houghton Mifflin.

Anderson, W. R., Cruz, M. G., Fernandes, P. M., Mccaw, L., Vega, J. A., Bradstock, R. A., . . . van Wilgen, B. W. (2015). A generic, empirical-based model for predicting rate of fire spread in shrublands. *International Journal of Wildland Fire, 24*(4), 443-460. doi:10.1071/Wf14130

Adoption of codes by reference; limitations; method of adoption; fire sprinklers; fire apparatus access roads or approved routes; intent; state preemption; fire watch requirements; pool barrier gates, Ariz. Rev. Stat. Ann. § 11-861 (2016).

Arizona Cooperative Extention. (2015, June 15, 2015). Yavapai County Native Naturalized Plants, Plant Communities. 5. Retrieved from http://cals.arizona.edu/yavapaiplants/PlantCommunities/PlantCommunities.php

Arizona State Forestry. (n.d.). Fire Supression. Retrieved from https://azsf.az.gov/fire/suppression

Bang, H. K., Ellinger, A. E., Hadjimarcou, J., & Traichal, P. A. (2000). Consumer concern, knowledge, belief, and attitude toward renewable energy: An application of the reasoned action theory. *Psychology & Marketing, 17*(6), 449-468. doi:10.1002/(Sici)1520-6793(200006)

Bates, B. R., Quick, B. L., & Kloss, A. A. (2009). Antecedents of intention to help mitigate wildfire: Implications for campaigns promoting wildfire mitigation to the general public in the wildland–urban interface. *Safety Science, 47*(3), 374-381.

Beatson, R., & McLennan, J. (2011). What Applied Social Psychology Theories Might Contribute to Community Bushfire Safety Research After Victoria's "Black Saturday". *Australian Psychologist, 46*(3), 171-182. doi:10.1111/j.1742-9544.2011.00041.x

Bourque, L. B., Regan, R., Kelley, M. M., Wood, M. M., Kano, M., & Mileti, D. S. (2013). An Examination of the Effect of Perceived Risk on Preparedness Behavior. *Environment and Behavior, 45*(5), 615-649. doi:10.1177/0013916512437596

Brenkert-Smith, H. (2011). Homeowners' Perspectives on the Parcel Approach to Wildland Fire Mitigation: The Role of Community Context in Two Colorado Communities. *Journal of Forestry, 109*(4), 193-200. Retrieved from <Go to ISI>://WOS:000292068200003

Brenkert-Smith, H., Champ, P. A., & Flores, N. (2006). Insights into wildfire mitigation decisions among wildland-urban interface residents. *Society & Natural Resources, 19*(8), 759-768. doi:10.1080/08941920600801207

Brenkert-Smith, H., Champ, P. A., & Flores, N. (2012). Trying Not to Get Burned: Understanding Homeowners' Wildfire Risk-Mitigation Behaviors. *Journal of environmental management, 50*(6), 1139-1151. doi:10.1007/s00267-012-9949-8

Brenkert-Smith, H., Dickinson, K. L., Champ, P. A., & Flores, N. (2013). Social Amplification of Wildfire Risk: The Role of Social Interactions and Information Sources. *Risk Analysis, 33*(5), 800-817. doi:10.1111/j.1539-6924.2012.01917.x

Bright, A. D. (2003). A within-subjects/multiple behavior alternative application of the theory of reasoned action: A case study of preferences for recreation facility development. *Leisure Sciences, 25*(4), 327-340. doi:10.1080/01490400390240455

Brown, D. J., Nowlin, W. H., Ozel, E., Mali, I., Episcopo, D., Jones, M. C., & Forstner, M. R. J. (2014). Comparison of short term low, moderate, and high severity fire impacts to aquatic and terrestrial ecosystem components of a southern USA mixed pine/hardwood forest. *Forest Ecology and Management, 312*, 179-192. doi:10.1016/j.foreco.2013.10.006

Browne, M. W., & Cudeck, R. (1992). Alternative Ways of Assessing Model Fit. *Sociological Methods & Research, 21*(2), 230-258. doi: 10.1177/0049124192021002005

Budruk, M., Wilhem Stanis, S. A., Schneider, I. E., & Heisey, J. J. (2008). Crowding and experience-use history: a study of the moderating effect of place attachment among water-based recreationists. *Environmental Management, 41*(4), 528-537. doi:10.1007/s00267-007-9059-1

Byrne, B. M. (2012). *Structural equation modeling with Mplus : basic concepts, applications, and programming*. New York: Routledge Academic.

Champ, P. A., & Brenkert-Smith, H. (2016). Is seeing believing? Perceptions of wildfire risk over time. *Risk Analysis*, 36(4), 816-830.

Champ, P. A., Donovan, G. H., & Barth, C. M. (2013). Living in a tinderbox: Wildfire risk perceptions and mitigating behaviors. *International Journal of Wildland Fire, 22*, 832-840.

Chen, T. L., & Chen, T. J. (2006). Examination of attitudes towards teaching online courses based on theory of reasoned action of university faculty in Taiwan. *British Journal of Educational Technology, 37*(5), 683-693. Doi: 10.1111/j.1467-8535.2006.00590.x

Cheng, A. S., Steelman, T., & Moseley, C. (2011). *Examining changes in wildfire policy and governance in the United States through three analytical lenses.* Paper presented at the Second conference on the human dimensions of wildland fire.

Cheng, S., Lam, T., & Hsu, C. H. C. (2006). Word-of-mouth communication intention: An application ot the theory of planned behavior. *Journal of Hospitality & Tourism Research, 30*(1), 95-116. doi:10.1177/1096348005284269

City of Prescott Office of Tourism. (n.d.). Home. Retrieved from http://www.visit-prescott.com/

Cohen, J., Cohen, P., West, S., & Aiken, L. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Mahwah, N.J.: L. Erlbaum Associates.

Cole, D. A., & Preacher, K. J. (2014). Manifest Variable Path Analysis: Potentially Serious and Misleading Consequences Due to Uncorrected Measurement Error. *Psychological Methods, 19*(2), 300-315. doi:10.1037/a0033805

Collins, T. W. (2008). What Influences Hazard Mitigation? Household Decision Making About Wildfire Risks in Arizona's White Mountains. *The Professional Geographer, 60*(4), 508-526. doi:10.1080/00330120802211737

Collins, T. W., & Bolin, B. (2009). Situating hazard vulnerability: people's negotiations with wildfire environments in the U.S. southwest. *Environmental Management, 44*(3), 441-455. doi:10.1007/s00267-009-9333-5

Conner, M., Warren, R., Close, S., & Sparks, P. (1999). Alcohol consumption and the theory of planned behavior: An examination of the cognitive mediation of past behavior. *Journal of Applied Social Psychology, 29*(8), 1676-1704. doi:10.1111/j.1559-1816.1999.tb02046.x

Covington, W. W., & Moore, M. M. (1994). Postsettlement Changes in Natural Fire Regimes and Forest Structure. *Journal of Sustainable Forestry, 2*(1-2), 153-181. doi:10.1300/J091v02n01_07

Creswell, J. W. (2009). *Research design : qualitative, quantitative, and mixed methods approaches* (3rd ed.). Los Angeles: Sage.

Cuevas, C., & Romero, F. (2010). Application of the Theory of Reasoned Action in Parents Intention to Vaccinate Their Daughters against Hpv. *International Journal of Behavioral Medicine, 17*, 150-151. Retrieved from <Go to ISI>://WOS:000280088500351

Davis, J. B. (1990). The wildland-urban interface: paradise or battleground? *Journal of Forestry, 88*(1), 26. Retrieved from

Definitions, Ariz. Rev. Stat. Ann. § 33-1802 (2015).

Dickinson, K., Brenkert-Smith, H., Champ, P., & Flores, N. (2015). Catching Fire? Social Interactions, Beliefs, and Wildfire Risk Mitigation Behaviors. *Society & Natural Resources*, 1-18. doi:10.1080/08941920.2015.1037034

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). *Internet, mail, and mixed-mode surveys : the tailored design method* (3rd ed.). Hoboken, N.J.: Wiley & Sons.

DiStefano, C & Motl, R.W. (2006). Further Investigating Method Effects Associated With Negatively Worded Items on Self-Report Surveys. *Structural Equation Modeling: A Multidisciplinary Journal, 13*(3), 440-464. doi: 10.1207/s15328007sem1303_6

Doane, A. N., Pearson, M. R., & Kelley, M. L. (2014). Predictors of cyberbullying perpetration among college students: An application of the Theory of Reasoned Action. *Computers in Human Behavior, 36,* 154-162. doi: 10.1016/j.chb.2014.03.051

Duangpunmat, U., Kalampakorn, S., & Pichayapinyo, P. (2013). An effect of walking exercise applying the theory of planned behavior in people at risk of hypertension. *J Med Assoc Thai, 96 Suppl 5,* S122-130.

DuBay, D. A., Ivankova, N., Herby, I., Wynn, T. A., Kohler, C., Berry, B., Martin, M. Y. (2014). African American organ donor registration: a mixed methods design using the theory of planned behavior. *Prog Transplant, 24*(3), 273-283. doi:10.7182/pit2014936

Evans, A., Auerbach, S., Wood Miller, L., Wood, R., Nystrom, K., Loevner, J., Aragon, A., Piccarello, M., Krasilovsky, E. (2015). *Evaluating the effectiveness of wildfire mitigation activities in the wildland-urban interface*. Madison, WI: Forest Stewards Guild.

Faulkner, H., Mcfarlane, B. L., & Mcgee, T. K. (2009). Comparison of homeowner response to wildfire risk among towns with and without wildfire management. *Environmental Hazards-Human and Policy Dimensions, 8*(1), 38-51. doi: 10.3763/ehaz.2009.0006

Finigan-Carr, N. M., Cheng, T. L., Gielen, A., Haynie, D. L., & Simons-Morton, B. (2014). Using the Theory of Planned Behavior to Predict Aggression and Weapons Carrying in Urban African American Early Adolescent Youth. *Health Educ Behav*. doi:10.1177/1090198114548479

Fire Adapted Communities Coalition. (n.d.). Guide to fire addapted communities. Retrieved from www.FireAdapted.org

Fire districts; powers and duties; definitions Ariz. Rev. Stat. Ann. § 48-805 (2016).

Fishbein, M. (1963). An investigation of the relationship between beliefs about an object and the attitude toward that object. *Human relations, 16*(3), 233-239.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior :an introduction to theory and research*. Reading, MA: Addison-Wesley Pub. Co.

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior :the reasoned action approach*. New York: Psychology Press.

Frew, P. M., Painter, J. E., Hixson, B., Kulb, C., Moore, K., del Rio, C., Omer, S. B. (2012). Factors mediating seasonal and influenza A (H1N1) vaccine acceptance among ethnically diverse populations in the urban south. *Vaccine, 30*(28), 4200-4208. doi:10.1016/j.vaccine.2012.04.053

Gallucci, A., Martin, R., Beaujean, A., & Usdan, S. (2015). An examination of the misuse of prescription stimulants among college students using the theory of planned behavior. *Psychol Health Med, 20*(2), 217-226. doi:10.1080/13548506.2014.913800

Gastil, J. (2000). Thinking, drinking, and driving: Application of the theory of reasoned action to DWI prevention. *Journal of Applied Social Psychology, 30*(11), 2217-2232. doi: 10.1111/j.1559-1816.2000.tb02433.x

Gordon, J. S., Luloff, A., & Stedman, R. C. (2012). A Multisite Qualitative Comparison of Community Wildfire Risk Perception. *Journal of Forestry, 110*(2), 74-78. doi: 10.5849/Jof.10-086

Gordon, J. S., Matarrita-Cascante, D., Stedman, R. C., & Luloff, A. E. (2010). Wildfire Perception and Community Change. *Rural Sociology, 75*(3), 455-477. doi: 10.1111/j.1549-0831.2010.00021.x

Gulley, T., & Boggs, D. (2014). Time perspective and the theory of planned behavior: moderate predictors of physical activity among central appalachian adolescents. *J Pediatr Health Care, 28*(5), 41-47. doi:10.1016/j.pedhc.2014.02.009

Hackman, C. L., & Knowlden, A. P. (2014). Theory of reasoned action and theory of planned behavior-based dietary interventions in adolescents and young adults: a systematic review. *Adolesc Health Med Ther, 5*, 101-114. doi:10.2147/AHMT.S56207

Hagger, M. S., Chatzisarantis, N. L., Barkoukis, V., Wang, J. C., Hein, V., Pihu, M., . . . Karsai, I. (2007). Cross-cultural generalizability of the theory of planned behavior among young people in a physical activity context. *J Sport Exerc Psychol, 29*(1), 2-20. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17556773

Haines, T. R., Cheryl ; Reams, Margaret. (2008, November). *County and municipal ordinances to protect wildland-urban interface communities.* Paper presented at the Forestry in a Climate of Change National Convention, Reno-Tahoe, Nevada.

Hammer, R. B., Stewart, S. I., Hawbaker, T. J., & Radeloff, V. C. (2009). Housing growth, forests, and public lands in Northern Wisconsin from 1940 to 2000. *Journal of environmental management, 90*(8), 2690-2698. doi: 10.1016/j.jenvman.2009.02.012

Hammer, R. B., Stewart, S. I., & Radeloff, V. C. (2009). Demographic Trends, the Wildland-Urban Interface, and Wildfire Management. *Society & Natural Resources, 22*(8), 777-782. doi: 10.1080/08941920802714042

Hammitt, W. E., Backlund, E. A., & Bixler, R. D. (2004). Experience Use History, Place Bonding and Resouce Substitution of Trout Anglers During Recreation Engagements. *Journal of Leisure Research, 36*(3), 356-378.

Hammitt, W. E., McDonald, C. D., & Patterson, M. C. (1990). Determinants of multiple satisfaction for deer hunting. *Wildlife Society Bulletin, 18*(3), 331-337.

Hanson, M. J. (1997). The theory of planned behavior applied to cigarette smoking in African-American, Puerto Rican, and non-Hispanic white teenage females. *Nurs Res, 46*(3), 155-162.

Heirman, W., & Walrave, M. (2012). Predicting adolescent perpetration in cyberbullying: an application of the theory of planned behavior. *Psicothema, 24*(4), 614-620.

Hill, A. J., Boudreau, F., Amyot, E., Dery, D., & Godin, G. (1997). Predicting the stages of smoking acquisition according to the theory of planned behavior. *J Adolesc Health, 21*(2), 107-115.

Hollis, J. J., Matthews, S., Anderson, W. R., Cruz, M. G., & Burrows, N. D. (2011). Behind the flaming zone: Predicting woody fuel consumption in eucalypt forest fires in southern Australia. *Forest Ecology and Management, 261*(11), 2049-2067. doi:10.1016/j.foreco.2011.02.031

Hu, L. T., & Bentler, P. M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling-a Multidisciplinary Journal, 6*(1), 1-55. doi: 10.1080/10705519909540118

Huchting, K., Lac, A., & LaBrie, J. W. (2008). An application of the Theory of Planned Behavior to sorority alcohol consumption. *Addict Behav, 33*(4), 538-551. doi:10.1016/j.addbeh.2007.11.002

Husari, S. J., & McKelvey, K. S. (1996). *Fire management policies and programs.* Paper presented at the Sierra Nevada ecosystem project: final report to Congress.

Jakes, P., Kruger, L., Monroe, M., Nelson, K., & Sturtevant, V. (2007). Improving wildfire preparedness: Lessons from communities across the US. *Human Ecology Review, 14*(2), 188-197.

James, W. (2013). *The Moral Equivalent of War: International Conciliation, No.27, February, 1910*. Whitefish, MT: Literary Licensing, LLC.

Jeffres, L. W., Carroll, J. A., Rubenking, B. E., & Amschlinger, J. (2008). Communication as a predictor of willingness to donate one's organs: an addition to the theory of reasoned action. *Prog Transplant, 18*(4), 257-262.

Jemmott, J. B., 3rd, Jemmott, L. S., & Hacker, C. I. (1992). Predicting intentions to use condoms among African-American adolescents: the theory of planned behavior as a model of HIV risk-associated behavior. *Ethnicity & Disease, 2*(4), 371-380.

Kam, J. A., Matsunaga, M., Hecht, M. L., & Ndiaye, K. (2009). Extending the theory of planned behavior to predict alcohol, tobacco, and marijuana use among youth of Mexican heritage. *Prevention Science, 10*(1), 41-53. doi:10.1007/s11121-008-0110-0

Karvinen, K. H., Courneya, K. S., Plotnikoff, R. C., Spence, J. C., Venner, P. M., & North, S. (2009). A prospective study of the determinants of exercise in bladder cancer survivors using the Theory of Planned Behavior. *Support Care Cancer, 17*(2), 171-179. doi:10.1007/s00520-008-0471-8

Kasprzyk, D., & Montano, D. E. (1998). Application of an integrated behavioral model to predict condom use: A perspective study among high HIV risk group. *Journal of Applied Social Psychology, 28*(17), 1557-1583.

Keats, M. R., Culos-Reed, S. N., Courneya, K. S., & McBride, M. (2007). Understanding physical activity in adolescent cancer survivors: an application of the theory of planned behavior. *Psychooncology, 16*(5), 448-457. doi:10.1002/pon.1075

Kent, B., Gebert, K., McCaffrey, S., Martin, W., Calkin, D., Schuster, E., Ekarius, C. (2003). *Social and Economic Issues of the Hayman Fire* (Report No. RMRS-GTR-114). Logan, UT: U.S. Rocky Mountain Research Station.

Kerner, M. S., Grossman, A. H., & Kurrant, A. B. (2001). The theory of planned behavior as related to intention to exercise and exercise behavior. *Perceptual & Motor Skills, 92*(3 Pt 1), 721-731. doi:10.2466/pms.2001.92.3.721

Kim, K., Reicks, M., & Sjoberg, S. (2003). Applying the theory of planned behavior to predict dairy product consumption by older adults. *J Nutr Educ Behav, 35*(6), 294-301.

Kim, Y. H., Kim, M., & Goh, B. (2011). An examination of food tourist's behavior: Using the modified theory of reasoned action. *Tourism Management, 32*(5), 1159-1165. doi:DOI 10.1016/j.tourman.2010.10.006

Kline, C. S., Greenwood, J.B., Swanson, J., Cardenas, D. (2014). Paddler market segments: Expanding experience use history segentation. *Journal of Destination Marketing & Management, 2*, 228-240.

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York: Guilford Press.

Kreye, J. K., & Kobziar, L. N. (2015). The effect of mastication on surface fire behaviour, fuels consumption and tree mortality in pine flatwoods of Florida, USA. *International Journal of Wildland Fire, 24*(4), 573-579. doi:10.1071/Wf14186

Kreye, J. K., Kobziar, L. N., & Zipperer, W. C. (2013). Effects of fuel load and moisture content on fire behaviour and heating in masticated litter-dominated fuels. *International Journal of Wildland Fire, 22*(4), 440-445. doi:10.1071/Wf12147

Kruger, L. E., Agrawal, S., Monroe, M., Lang, E., Nelson, K., Jakes, P., Sturtevent, V., McCaffrey, S., and Everett, Y. (2002, March). *Keys to community preparedness for wildfire.* Paper presented at the Ninth International Symposium on Society and Resource Management, Bloomington, IN.

Kurtz, L. (2006). *Sampling of legislative treatment of wildfire mitigation in the wildland-urban interface: Utah, Oregon, Arizona, Claifornia*. Environmental Quality Council Assigned Studies Subcommittee, Montana State Legislature.

Kuther, T. L. (2002). Rational decision perspectives on alcohol consumption by youth. Revising the theory of planned behavior. *Addictive Behaviors, 27*(1), 35-47. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11800223

Li, M. Y., Frieze, I., & Tang, C. S. (2010). Understanding adolescent peer sexual harassment and abuse: using the theory of planned behavior. *Sex Abuse, 22*(2), 157-171. doi:10.1177/1079063210363827

Liou, C., & Leech, I. (2010). Predict Saving Behavior for Retirement: Applicability of the Theory of Reasoned Action. *Gerontologist, 50*, 123-123.

Lowe, S. S., Watanabe, S. M., Baracos, V. E., & Courneya, K. S. (2012). Determinants of physical activity in palliative cancer patients: an application of the theory of planned behavior. *Journal of Community and Supportive Oncology, 10*(1), 30-36. doi:10.1016/j.suponc.2011.07.005

Marandu, E. E. (2009). *Testing the theory of reasoned action and its extensions : predicting intention to use condoms*. Addis Ababa: Organisation for Social Science Research in Eastern and Southern Africa.

Marsh, H. W. (1984). Students' evaluations of university teaching: Dimensionality, reliability, validity, potential baises, and utility. *Journal of Educational Psychology, 76*(5), 707-754. doi: 10.1037/0022-0663.76.5.707

Martin, I. M., Bender, H., & Raish, C. (2007). What motivates individuals to protect themselves from risks: the case of wildland fires. *Risk Analysis, 27*(4), 887-900.

Martin, J. J., Oliver, K., & McCaughtry, N. (2007). The theory of planned behavior: predicting physical activity in Mexican American children. *Journal of Sport Exercize Psychology, 29*(2), 225-238.

Martin, W., Martin, I. M., & Kent, B. (2009). The role of risk perceptions in the risk mitigation process: the case of wildfire in high risk communities. *Journal of environmental management, 91*(2), 489-498. doi:10.1016/j.jenvman.2009.09.007

Martinuzzi, S., Stewart, S. I., Helmers, D. P., Mockrin, M. H., Hammer, R. B., & Radeloff, V. C. (2015). The 2010 wildland-urban interface of the conterminous United States - geospatial data Retrieved from Forest Service Research Data Archive http://dx.doi.org/10.2737/RDS-2015-0012.

McCaffrey, S., Stidham, M., Toman, E., & Shindler, B. (2011). Outreach Programs, Peer Pressure, and Common Sense: What Motivates Homeowners to Mitigate Wildfire Risk? *Environmental Management, 48*(3), 475-488. doi: 10.1007/s00267-011-9704-6

McCaffrey, S., & Winter, G. (2011, April). Understanding homeowner preparation and intended actions when threatened by a wildfire. *Proceedings of the second human dimensions of wildland fire conference*, USA, GTR-NRS-P-84, 88-95.

McFarlane, B. L., Mcgee, T. K., & Faulkner, H. (2011). Complexity of homeowner wildfire risk mitigation: an integration of hazard theories. *International Journal of Wildland Fire, 20*(8), 921-931. doi: 10.1071/Wf10096

McLaws, M. L., Maharlouei, N., Yousefi, F., & Askarian, M. (2012). Predicting hand hygiene among Iranian health care workers using the theory of planned behavior. *American Journal of Infection Control, 40*(4), 336-339. doi:10.1016/j.ajic.2011.04.004

McNeill, I. M., Dunlop, P. D., Heath, J. B., Skinner, T. C., & Morrison, D. L. (2013). Expecting the Unexpected: Predicting Physiological and Psychological Wildfire Preparedness from Perceived Risk, Responsibility, and Obstacles. *Risk Analysis, 33*(10), 1829-1843. doi: 10.1111/Risa.12037

Mishra, D., Akman, I., & Mishra, A. (2014). Theory of Reasoned Action application for Green Information Technology acceptance. *Computers in Human Behavior, 36*, 29-40. doi: 10.1016/j.chb.2014.03.030

Monroe, M. C., Agrawal, S., Jakes, P. J., Kruger, L. E., Nelson, K. C., & Sturtevant, V. (2013). Identifying Indicators of Behavior Change: Insights From Wildfire Education Programs. *Journal of Environmental Education, 44*(3), 180-194. doi:10.1080/00958964.2012.746277

Montano, D. E., Kasprzyk, D., Hamilton, D. T., Tshimanga, M., & Gorn, G. (2014). Evidence-based identification of key beliefs explaining adult male circumcision motivation in Zimbabwe: targets for behavior change messaging. *AIDS Behavior, 18*(5), 885-904. doi:10.1007/s10461-013-0686-7

Nash, R. F. (2001). *Wilderness and the American mind* (Fourth ed.). New Haven, CT: Yale University Press.

National Fire Protection Association. (2009). Introduction to Firewise Principles: A presentation for general audiences (2nd Edition ed., pp. 32). Quincy, MA: National Fire Protection Association.

National Interagency Coordination Center. (2015). *Wildland Fire Summary and Statistics Annual Report 2014*. Retrieved from http://www.predictiveservices.nifc.gov/intelligence/2014_Statssumm/2014Stats&Summ.html

National Interagency Fire Center. (2015). Federal Firefighting Costs (Suppression Only). Retrieved from https://www.nifc.gov/fireInfo/fireInfo_statistics.html

National Wildfire Coordination Group Training Working Team. (2006). *Introduction to Wildland Fire Behavior S-190 Student Workbook.* (NFES 2901). Boise, Idaho: National Interagency Fire Center.

Nelson, K., Monroe, M. C., Johnson, J. F., & Bowers, A. (2004). Living with fire: homeowner assessment of landscape values and defensible space in Minnesota and Florida, USA. *International Journal of Wildland Fire, 13*(4), 413-425. doi: 10.1071/Wf03067

Nelson, K., Monroe, M. C., Johnson, J. F., & Bowers, A. W. (2003, June). *Public perceptions of defensible space and landscape values in Minnesota and Florida.* Paper presented at the Internationa Symposium on Society and Resource Management, Bloomington, IN.

Nguyen, M. N., Potvin, L., & Otis, J. (1997). Regular exercise in 30- to 60-year-old men: combining the stages-of-change model and the theory of planned behavior to identify determinants for targeting heart health interventions. *J Community Health, 22*(4), 233-246.

Noonan, D., Kulbok, P., & Yan, G. F. (2011). Intention to Smoke Tobacco Using a Waterpipe Among Students in a Southeastern US College. *Public Health Nursing, 28*(6), 494-502. doi:10.1111/j.1525-1446.2011.00945.x

O'Boyle, C. A., Henly, S. J., & Larson, E. (2001). Understanding adherence to hand hygiene recommendations: the theory of planned behavior. *American Journal of Infection Control, 29*(6), 352-360. doi:10.1067/mic.2001.18405

Office of Policy Analysis. (2012). *Wildland fire management program benefit-cost analysis: A review of relevant literature*, Washington, DC: U.S. Department of the Interior.

Paek, H.-J., Hilyard, K., Freimuth, V., Barge, J. K., & Mindlin, M. (2010). Theory-based approaches to understanding public emergency preparedness: Implications for effective health and risk communication. *Journal of Health Communication, 15*, 428-444. doi:10.1080/10810731003753083

Painter, J. E., Sales, J. M., Pazol, K., Wingood, G. M., Windle, M., Orenstein, W. A., & DiClemente, R. J. (2010). Psychosocial correlates of intention to receive an influenza vaccination among rural adolescents. *Health Education Research, 25*(5), 853-864. doi:10.1093/her/cyq037

Partners in Protection. (2003). *FireSmart: Protecting your community from wildfire*. Edmonton, Alberta. CA: FireSmart Canada. Retrieved from https://www.firesmartcanada.ca/resources-library/protecting-your-community-from-wildfire

Petrick, J. (2002). Experience use history as a segmentation tool to examine golf travellers' satisfaction, perceived value and repurchase intentions. *Journal of Vacation Marketing, 8*(4), 332-342.

Polonsky, M. J., Renzaho, A. M., Ferdous, A. S., & McQuilten, Z. (2013). African culturally and linguistically diverse communities' blood donation intentions in Australia: integrating knowledge into the theory of planned behavior. *Transfusion, 53*(7), 1475-1486. doi:10.1111/j.1537-2995.2012.03915.x

Pyne, S. J. (1997). *Fire in America: A Cultural History of Wildland and Rural Fire*. Seattle, WA: University of Washington Press.

Pyne, S. J. (2004). *Tending fire: Coping with America's wildland fires*. Washington, DC: Island Press.

Radeloff, V. C., Hammer, R. B., Stewart, S. I., Fried, J. S., Holcomb, S. S., & McKeefry, J. F. (2005). The wildland-urban interface in the United States. *Ecological Applications, 15*(3), 799-805. doi: 10.1890/04-1413

Rah, J. H., Hasler, C. M., Painter, J. E., & Chapman-Novakofski, K. M. (2004). Applying the theory of planned behavior to women's behavioral attitudes on and consumption of soy products. *Journal of Nutrition Education and Behavior, 36*(5), 238-244.

Reiners, D. (2012). Institutional Effects on Decision Making on Public Lands: An Interagency Examination of Wildfire Management. *Public Administration Review, 72*(2), 177-186. doi: 10.1111/j.1540-6210.2011.02486.x

Robinson, N. G., Masser, B. M., White, K. M., Hyde, M. K., & Terry, D. J. (2008). Predicting intentions to donate blood among nondonors in Australia: an extended theory of planned behavior. *Transfusion, 48*(12), 2559-2567. doi:10.1111/j.1537-2995.2008.01904.x

Seo, S., Kim, O. Y., & Shim, S. (2014). Using the theory of planned behavior to determine factors influencing processed foods consumption behavior. *Nutrition Research and Practice, 8*(3), 327-335. doi:10.4162/nrp.2014.8.3.327

Sheeran, P., & Orbell, S. (2000). Self-schemas and the theory of planned behaviour. *European Journal of Social Psychology, 30*(4), 533-550.

Shepherd, R., & Towler, G. (2007). Nutrition knowledge, attitudes and fat intake: application of the theory of reasoned action. *Journal of Human Nutrition and Dietetics, 20*(3), 159-169. Retrieved from <Go to ISI>://WOS:000247135100006

Singleton, R. A. a. S., Bruce C. (2010). *Approaches to Social Research* (5th ed.). New York, NY: Oxford University Press, Inc.

Sisser, J. M., Nelson, K. C., Larson, K. L., Ogden, L. A., Polsky, C., & Chowdhury, R. R. (2016). Lawn enforcement: How municipal policies and neighborhood norms influence homeowner residential landscape management. *Landscape and Urban Planning, 150*, 16-25. doi:http://dx.doi.org/10.1016/j.landurbplan.2016.02.011

Slovic, P. (1987). Perception of Risk. *Science, 236*(4799), 280-285. doi: 10.1126/science.3563507

Southwest Coordination Center. (n.d.). About Us. Retrieved from http://gacc.nifc.gov/swcc/About_Us/About_Us.htm

Stevens, J. T., Safford, H. D., & Latimer, A. M. (2014). Wildfire-contingent effects of fuel treatments can promote ecological resilience in seasonally dry conifer forests. *Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 44*(8), 843-854. doi: 10.1139/cjfr-2013-0460

Sulak, T. N., Saxon, T. F., & Fearon, D. (2014). Applying the Theory of Reasoned Action to Domestic Violence Reporting Behavior: The Role of Sex and Victimization. *Journal of Family Violence, 29*(2), 165-173. doi: 10.1007/s10896-013-9569-y

Tanase, M. A., Panciera, R., Lowell, K., & Aponte, C. (2015). Monitoring live fuel moisture in semiarid environments using L-band radar data. *International Journal of Wildland Fire, 24*(4), 560-572. doi:10.1071/Wf14149

Terry, D. J., Gallois, C., & McCamish, M. (1993). *The Theory of reasoned action : its application to AIDS-preventive behavior* (1st ed.). Oxford, England ; New York: Pergamon Press.

Thrasher, R. G., Andrew, D. P. S., & Mahony, D. F. (2011). The Efficacy of a Modified Theory of Reasoned Action to Explain Gambling Behavior in College Students. *Journal of Gambling Studies, 27*(3), 499-516. doi: 10.1007/s10899-010-9215-z

Tsai, M. T., Chin, C. W., & Chen, C. C. (2010). The Effect of Trust Belief and Salesperson's Expertise on Consumer's Intention to Purchase Nutraceuticals: Applying the Theory of Reasoned Action. *Social Behavior and Personality, 38*(2), 273-287. doi: 10.2224/sbp.2010.38.2.273

U.S. Bureau of Labor Statistics. (n.d.). CPI Inflation Calculator. Retrieved 12/2015, from United States Department of Labor http://www.bls.gov/data/inflation_calculator.htm

United States Census Bureau. (2015). State & County QuickFacts: Prescott City, Arizona. Retrieved from http://www.census.gov/quickfacts/table/PST045214/0457380,00

United States Department of the Interior. (1995). *Federal Wildland Fire Management Policy & Program Review: Final Report*. Boise, ID: National Interagency Fire Center.

Urban-Wildland Interface Code, Prescott City Code § 6-2 (2015).

Van Hooft, E. A. J., Born, M. P., Taris, T. W., & Van der Flier, H. (2006). Ethnic and gender differences in applicants' decision-making processes: An application of the theory of reasoned action. *International Journal of Selection and Assessment, 14*(2), 156-166. doi: 10.1111/j.1468-2389.2006.00341.x

Vardi, Y., & Weitz, E. (2002). Using the theory of reasoned action to predict organizational misbehavior. *Psychological Reports, 91*(3), 1027-1040. doi: 10.2466/Pr0.91.7.1027-1040

Vogt, C., McCaffrey, S., & Winter, G. (2011, April). *Defensible space features: impact of voluntary versus mandatory programs on a homeowner's attitudes and actions.* Paper presented at the Proceedings of the Second Conference on the Human Dimensions of Wildland Fire. GTR-NRS-P-84. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station.

Vogt, C., Winter, G., & Fried, J. S. (2005). Predicting homeowners' approval of fuel management at the wildland-urban interface using the theory of reasoned action. *Society & Natural Resources, 18*(4), 337-354. doi: 10.1080/08941920590915242

Vogt, C., Winter, G., & McCaffrey, S. (2007). *Homeowner response to wildfire hazard mitigation incentives.* Paper presented at the Extended Abstracts from the Human Dimensions of Wildland Fire Conference.

Weems, G. H., Onwuegbuzie, A. J., Collins, K. T. (2006). The Role of Reading Comprehension in Responses to Positively and Negatively Worded Items on Rating Scales. *Evaluation & Research in Education, 19*(1), 3-20. doi: 10.1080/09500790608668322

White, D. D., Virden, R.J., Van Riper, C.J. (2008). Effects of place identity, place dependence, and experience-use history on perceptions of recreation impacts in a natural setting. *Environmental Management, 42*, 647-657. doi:10.1007/s00267-008-9143-1

Wildland-Urban Interface Code, Ariz. Rev. Stat. Ann. § 9-806 (2016).

Wildland Fire Leadership Council. (2011). *The Federal Land Assistance, Management and Enhancement Act of 2009: Report to Congress*.

Wildland Urban Interface Mitigation Committee. (2014). *Wildfire Urban Interface Wildfire Mitigation Desk Reference Guide*. Retrieved from http://www.nwcg.gov

Williams, L. J., & O'Boyle Jr, E. H. (2008). Measurement models for linking latent variables and indicators: A review of human resource management research using parcels. *Human Resource Management Review, 18*(4), 233-242. doi:http://dx.doi.org/10.1016/j.hrmr.2008.07.002

Williams, S.A. & Swanson, M.S. (2001). The effect of reading ability and response formats on patients' abilities to respond to a patient satisfaction scale. *The Journal of Continuing Education in Nursing, 32*(2), 60-67.

Winter, G., McCaffrey, S., & Vogt, C. A. (2009). The role of community policies in defensible space compliance. *Forest Policy and Economics, 11*(8), 570-578. doi: 10.1016/j.forpol.2009.07.004

Winter, G., Vogt, C., & Fried, J. (2002). Fuel treatments at the wildland-urban interface - Common concerns in diverse regions. *Journal of Forestry, 100*(1), 15-21.

Winter, P. L., & Cvetkovich, G. T. (2010). Shared values and trust: the experience of community residents in a fire-prone ecosystem. In: Pye, J.M.; Raushcer, H.M.; Sands, Y.; Lee, D.C.; Beatty, J.S., eds. Advances in threat assessment and their application to forest and rangeland management. Gen. Tech. Rep. PNW-802. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 409-418.

APPENDIX A

WILDLAND FIRE POLICIES

Wildland Fire Management Entities

- The U.S. Department of Agriculture Forest Service
- The U.S. Department of Interior
    - Bureau of Land Management
    - U.S. Fish and Wildlife Service
    - National Park Service
    - Bureau of Indian Affairs
- Department of Homeland Security,
    - Federal Emergency Management Agency (U.S. Fire Administration branch)

Wildland Fire Policies

- Weeks Act 1911(Office of Policy Analysis, 2012)
- Clarke-McNary Act 1924(Office of Policy Analysis, 2012)
- 10 Acre Policy 1926(Office of Policy Analysis, 2012)
- 10 am policy1935(Office of Policy Analysis, 2012)
- Leopold Repot 1963(Office of Policy Analysis, 2012)
- Wilderness Act 1964 (Office of Policy Analysis, 2012)
- Federal Wildland Fire Policy1995 (Office of Policy Analysis, 2012)
- Federal Wildland Fire Management Policy 2001 (Office of Policy Analysis, 2012)
- National Fire Plan 2001 Identifies goals for the increase of firefighting capacity, rehabilitation, fuel reduction, and community assistance to reduce

wildfire risk. (Cheng, Steelman, & Moseley, 2011; Office of Policy Analysis, 2012)

- Ten-year implementation plan, emphasizes a multi-governmental collaborative framework. This includes federal, state, Tribal, and local government entities in order to accomplish goals of fire suppression and prevention, fuel reduction, restoring fire adapted natural communities, and working with communities in risk reduction (Cheng et al., 2011).
- Wildland Fire Leadership council, federal, state, Tribal, and local governmental group that works to address current policies, resource allocation, prioritization of wildfire of needs, and budget issues. (Cheng et al., 2011)
- Healthy Forest Restoration Initiative 2002 (Office of Policy Analysis, 2012)
- Healthy Forest Restoration Act of 2003, intended to provide hazardous fuel reduction on U.S. Forest Service and Bureau of Land Management lands to reduce the risk of wildland fire to adjacent communities and associated watersheds. The act also identifies need to protect watersheds, address threats to forest and rangeland health. A key element to the act is that there is clear language for collaboration between federal, state and local governments in developing regional Community Wildfire Protection Plans. These community plans directly address the priorities of the federal act (Cheng et al., 2011; Office of Policy Analysis, 2012).

- Federal Land Assistance, Management & Enhancement (FLAME) Act 2009 (Office of Policy Analysis, 2012)
- National Cohesive Wildland Fire Management Strategy 2011 (Office of Policy Analysis, 2012)

APPENDIX B

WILDFIRE MITIGATION AND PROGRAMS

Wildland Urban Interface Mitigation Committee (2014) defines mitigation as an "effort to reduce loss of life and property by lessening the impact of disasters." Mitigation provides for a safer community through reducing the impact of life and property, creating a community that can recover quicker after a disaster, reduced financial impact to individuals and community, and reducing the risk to emergency response and firefighter personnel. Common mitigation practices as outlined by (Wildland Urban Interface Mitigation Committee, 2014).

- Actively managing vegetation near the home by reducing, maintaining and /or replacing with ignition-resistant components. Greater efforts are needed within close proximity of the structure and gradually decreasing efforts beyond that. For appropriate distances contact your local state forestry or state department.
- Maintaining structures free of needles, leaves, and other organic debris from decks, roofs, and near the base of exterior walls.
- Increasing ignition resistance of structures by actions such as using ignition resistant roofing and protecting exterior opening of structures by covering with non-flammable wire mesh screening (attic/soffits, crawl spaces, etc.)
- Removing flammable materials from beneath structure and decks.
- Locating firewood, fuel tanks, and LPG tanks at a safe distance from structures.

Fire Adapted communities

Wildland Urban Interface Mitigation Committee (2014) defines a Fire Adapted Community (FAC) as "A human community consisting of informed and prepared citizens collaboratively planning and taking action to safely co-exist with wildland fire." FAC is a conceptual ideal which is not static and not a specific program. FAC is a continual process that requires buy in by all members of the community, adaptation to changing conditions, and maintenance. In this sense, risk is shared by all members in the community and thus are all responsible for the safety of all other community members.

Wildland Urban Interface Mitigation Committee (2014) identifies six general actions which communities can take to become FAC. These include the developing of a Community Wildfire Protection Plan (CWPP), construction of or adaptation to existing structures on private lands to make ignition resistant homes and vegetation, training of local emergency responders in dealing with wildfire, fuel treatments on public and private lands, implementation of codes, covenants, and ordinances to promote mitigation actions, and Jurisdictional cooperation.

The Healthy Forest Restoration Act (HFRA) first defined the Community Wildfire Protection Plan which provided a priority to community with one in place to federal funding through receiving hazardous fuels reduction funding through the U.S. Forest Service and Bureau of Land Management. Local governments in at-risk areas for wildfire can develop a Community Wildfire Protection Plan (CWPP). These plans include a collaborative approach with the local government, firefighting agencies, community stockholders, forest management state agencies, and federal land

management agencies. The CWPP complexity is dependent upon the local communities location in the WUI, current conditions of vegetation and structures, and desired condition. Collaboration, prioritized fuel reduction, and treatment of structural ignitability are requirements of a CWPP (Wildland Urban Interface Mitigation Committee, 2014).

Other groups and programs

- Fire adapted communities coalition -
- Fire Learning Network - TNC
- Fire Safe Councils – Independent Grass Roots Org.
- Living with Fire – University of Nevada Cooperative Extension
- Ready, Set, Go! – International Association of Fire Chiefs

Policies

- Healthy Forest Restoration Act of 2003
- Federal Land Assistance Management and Enhancement (FLAME) Act of 2009
- National Cohesive Wildland Fire Management Strategy (Result of FLAME. Cohesive Strategy on restore and maintain landscapes, fire adapted communities, and wildfire response.
- Presidential Policy Directive/PPD-8 2011 (strengthen security and resilience of nation through preparation – prevention, protection, mitigation, response, and recovery. National Mitigation Framework establishes common platform for coordination and addressing how the nation manages risk. A Federal

Interagency Operation Plan was developed to implement NMF with a Mitigation Framework Leadership Group established.

- Quadrennial Fire Review – National Interagency Fire Center
- Whole Community approach to emergency management - FEMA

Firewise Communities

To become a recognized Firewise Community the following must be completed: an assessment of the community, formation of a firewise board or committee (develops an action plan and monitors activities), annually hold a firewise event day for the community, Invest $2 per capita annually into community mitigation efforts, and complete and submit a Firewise Communities application.

National Fire Protection Association (2009) suggests that by becoming a recognized Firewise Community, not only will risk of damage or loss to life and property be reduced due to the defensible space create, but community relationships will be improved between homeowners and firefighting agencies as well as building a more connected community.

Strategies for Firewise Construction, Goal is to use non-flammable materials and keep the structure sealed to keep any embers from entering though vents and gaps. Also keep areas on and around the structure clear of debris.

- Roof: use non-combustible materials (asphalt, metal, cement/concrete, or terra-cotta and clean regularly of debris.
- Chimney, eaves & vents: Close any gaps between chimney/vents and the roof/siding, place spark arresters on chimneys and screens over vents with a

mesh no larger than 1/8 inch. Enclose eaves to prevent embers entering the structure.

- Walls: use fire resistant (non-flammable) siding/materials on exterior walls like stucco and masonry.
- Windows: Do not use single pane glass as it can crack when exposed to radiant heat, Tempered double pane is preferred. use smaller windows, Window integrity is vital for keeping embers out of the structure. Avoid the use of plastic skylight as they can melt. Identify and seal any gaps between windows and siding and skylights and roof. Cover windows and skylights with non-flammable screening and shutters making sure there are no areas for embers to enter through gaps.
- Decks & porches: Enclose openings under decks and porches and removing any debris from under the decks and porches. Provide a gap or stone/brick buffer for wood fences that attach to the structure.
- Topography: Avoid slopes, natural saddles and chimneys.
- Access: Have roads and driveways properly signed and clearly addressed, have cul de sacs and parking areas large enough for fire engines to access the site, maneuver, and turn around.

Strategies for landscaping. NFPA identifies four zones the range in distances from a structure to provide better survivability during a wildfire. Zone 1 is referred to as the defensible space and is a radius of 30 feet from the structure. This distance is extended if any topography is present in the zone. This area is referred to as the

"greenbelt" or "survivable space" or "defensible space" and is the last line of defense to keep a fire from reaching a structure. Zone 1 also provides a relatively safe area around the home or structure for firefighters to work. In this zone fire resistant type plants should be used. Characteristics of such plants should have high moisture content, be woody or have fibrous stems and branched, be drought resistant with deep roots, and have little or no accumulation of dead plant material. Plants should not touch any structures or other plants. If the property is on a slope the distance between plants increased. Trees in this zone should be spaced or thinned to so they do not provide a continuous canopy or path to structures. Plant height should be kept as low as possible to limit flame height and trees should have no branches lower than six to ten feet above the ground. A well watered and kept green lawn will provide a good barrier to fire.

Zone 2 is the radius between 30 to 100 feet from a structure and when managed properly, can slow the advancement of a wildfire. Also known as the secondary buffer, this zone should be managed in such a way the trees do not ignite. Trees and plants should be pruned to 12 feet with flammable debris removed from under the canopy. Trees should also be thinned to allow for 30 feet between their canopies. Low plants and shrubs should be maintained through regular trimming. Do not allow dead and downed vegetation and woody debris to accumulate on the forest floor. Mow grass periodically and water to maintain green vegetation.

Zone 3 is referred to the out fuel transition zone and occurs 100 to 200 feet from a structure. Though Trees and plants in this zone should be maintained similar to those in

zone 2, trees can be taller. It is also good to maintain shrubs and grass as identified in zone 2 as well. This is also the zone in which fire wood storage is acceptable.

Zone 4 extends beyond 200 feet. Of most concern for structures on ridges and slopes, this zone allows trees to grow to their full height in properly spaced or thinned. Grass and weeds should be mowed or removed and low hanging tree branches should be trimmed.

APPENDIX C

INTERVIEW SCRIPT

Assessment of Neighborhood dynamics on wildfire Mitigation: Key informant Script

Interviewer: _____

Interview Number: _____

Date of Completion: _____

Background commentary:

1. Introduce interviewer and context for involvement.
2. Ensure anonymity– note that only pervasive themes extracted across interviews with no connections between specific comments and specific interviewees made. This includes no identifying information about the specific neighborhoods that could link back to the participant will be made.
3. Ask for consent to audio record the interview.
4. Explain the purpose of the interview and its connection to the study.

The first few questions are general and not necessarily centered on wildfire mitigation behaviors.

Tell me about yourself. How long you have lived in this neighborhood, what brought you here, how you are currently involved in the neighborhood, etc.

_____

_____

_____

_____

How would you describe this neighborhood in general? What is it about the neighborhood that attracted you to move here? What are the pros and cons of living in this neighborhood?

_____

_____

_____

_____

Next, I want to explore wildfire mitigation and firewise.

Are you aware of State, County, City, or HOA regulations on firewise construction and parcel maintenance that affect this neighborhood? Are you aware of programs available? Are the regulations/programs mandatory or voluntary? Are there penalties for non-compliance or incentives for compliance? Are the programs governmental?

_____

_____

_____

_____

Describe the residency in the neighborhood. Do homeowners tend to be longtime or new, seasonal or fulltime residents or a combination? If a combination, what is the ratio? How does this influence the dynamics of the neighborhood? How does this influence wildfire mitigation on private property?

_____

_____

_____

_____

In continuing with residency, please describe the type of residents. Are homeowners working a regular job (not retired) in the Prescott area, retired and residing permanently in the Prescott area, seasonal retired residents, etc. How does this influence the dynamics of the neighborhood? How does this influence wildfire mitigation action on private property?

_____

_____

_____

_____

Please describe neighborhoods efforts to become Firewise. Is the neighborhood a Firewise Community registered through the NFPA program? If so, how long has the neighborhood been a part of the program? How supportive is the neighborhood (HOA) of this designation? How active is the HOA and/or residents in supporting these actions in the neighborhood and on their private property?

_____

_____

_____

_____

What are the challenges you see or have experienced in attempting to gain homeowner compliance of firewise actions on private property in your neighborhood?

_____

_____

_____

_____

For the next few questions I want you to think about wildfire mitigation and firewise actions on your property and home.

What do you see as the advantages of completing wildfire mitigation/firewise actions on your property and home?

_____

_____

_____

_____

What do you see as disadvantages of completing wildfire mitigation/firewise actions on your property and home?

_____

_____

_____

What else comes to mind when you think about wildfire mitigation/firewise actions on your property and home?

_____

_____

_____

_____

When it comes to mitigating your property from the threat of wildfire, there might be individuals or groups who think you should or should not perform this behavior.

Please provide individuals (not by name, just association) or groups who would approve or think you should mitigate your property and home from wildfire risk?

_____

_____

_____

_____

Please provide individuals (not by name, just association) or groups who would disapprove or think you should not mitigate your property and home from wildfire risk?

_____

_____

_____

_____

Sometimes, when we are not sure what to do, we look to see what others are doing. Please provide individuals (not by name, just association) or groups in and around your neighborhood who are most likely to perform mitigation actions to become firewise?

_____

_____

_____

_____

Please list the individuals (not by name, just association) or groups in and around your neighborhood who are least likely to perform mitigation actions to become firewise?

_____

_____

_____

_____

Please list any factors or circumstances that would make it easy or enable you to complete mitigation actions on your property and home?

_____

_____

_____

_____

Please list any factors or circumstances that would make it difficult or prevent you from completing mitigation actions on your property and home?

_____

_____

_____

_____

I want to thank you for your patience and let you know that we are almost finished. I have just a couple more questions.

Is there anything else that you would like to share about your community, any social or demographic dynamics not previously expressed, any other concerns you are encountering with residents firewise actions, etc.?

_____

_____

_____

_____

To conclude this interview, would you or the HOA be willing to provide a copy of the community CC&R's and/or community assessment that was conducted for the firewise recognition?

_____

Neighborhood Assessment

Neighborhood: _____

Assessment date: __/__/__

Neighborhood Size

Total Acres: _____

Common Acres: _____

Total Lots: _____

Developed Lots: _____

Lot Characteristics:

Size (Acres): _____

Structure Characteristics:

☐ Single Family Home ☐ Townhome

☐ Condo ☐ Apartment

Neighborhood Age

Year of Development _____

☐ Single Story ☐ Multi Story

☐ Stick Built ☐ Brick/Block

Bordering lands:

Public: ☐ National Forest

☐ State Forest

☐ County

☐ City

Private: ☐ Businesses ☐ Neighborhoods

Comments:

_____

_____

Plant Community Surrounding Neighborhood:

Primary Vegetation Type: ☐ Desert Scrub ☐ Grass lands
☐ Interior Chaparral ☐ Pinyon Juniper Woodlands
☐ Montane Conifer Forest ☐ Riparian

Secondary Vegetation Type: ☐ Desert Scrub ☐ Grass lands
☐ Interior Chaparral ☐ Pinyon Juniper Woodlands
☐ Montane Conifer Forest ☐ Riparian

Comments:

_____

_____

Plant Community in Neighborhood:

Primary Vegetation Type: ☐ Desert Scrub ☐ Grass lands
☐ Interior Chaparral ☐ Pinyon Juniper Woodlands
☐ Montane Conifer Forest ☐ Riparian

Secondary Vegetation Type: ☐ Desert Scrub ☐ Grass lands
☐ Interior Chaparral ☐ Pinyon Juniper Woodlands
☐ Montane Conifer Forest ☐ Riparian

Comments:

_____

_____

Topography surrounding Neighborhood (within ½ miles):

Predominant Topography: ☐ Mountain ☐ Hill ☐ Saddle ☐ Ridge
☐ Valley ☐ Cliff ☐ Depression ☐ Ridgelines

Secondary Topography: ☐ Mountain ☐ Hill ☐ Saddle ☐ Ridge
☐ Valley ☐ Cliff ☐ Depression ☐ Ridgelines

Comments:

_____

_____

Topography in Neighborhood:

Predominant Topography: ☐ Mountain ☐ Hill ☐ Saddle ☐ Ridge
☐ Valley ☐ Cliff ☐ Depression ☐ Ridgelines

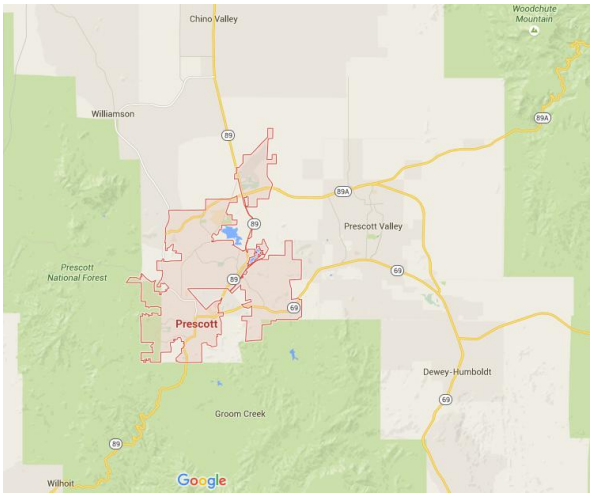
Secondary Topography: ☐ Mountain ☐ Hill ☐ Saddle ☐ Ridge
☐ Valley ☐ Cliff ☐ Depression ☐ Ridgelines

Comments:

_____

_____

Identify approximate location of neighborhood.



Desert Scrub

Desert scrub is found at the lowest elevations in Yavapai County. The vegetation is a scrubland or woodland. The spaces between the small trees or shrubs are filled with layers of shrubs, cacti, succulents, grasses, and in years of adequate moisture, annuals. The common trees are palo verde, cat-claw, mesquite and ironwood. Common shrubs are whitethorn, creosote and bur sage. Cacti are an important vegetation type and include saguaro, several species of cholla and many others. In the upper limits of this plant community crucifixion thorn is common. Bush muhly is probably the most palatable grass. Tobosa grass occurs in low places where runoff waters collect.

Grasslands

Semidesert grasslands occur largely at elevations between 4,000 and 5,000 feet. Typical areas occur in the Verde Valley, north of Prescott, in Chino and Lonesome Valleys, and along Interstate 40 between Ash Fork and Seligman. In climax plant communities, blue grama, tobosa, black grama, hairy grama, and side-oats grama predominate. Ring muhly and three-awn may be present but make up only a small part of the total vegetation.

Interior Chaparral

Interior chaparral is a shrub dominated plant community occurring most often between the elevations of 3,000 and 5,500 feet. An extensive stand of chaparral lies in the area between Cherry and Dewey and extends south past Humboldt and Mayer. Other typical areas are Iron Springs Road (northwest of Prescott), Wilhoit, and Camp Wood. Scrub oak often dominates our chaparral plant communities. Other shrubs include manzanita, lemonade berry, mountain mahogany, Apache plume, catclaw, cliffrose, ceanothus, and silktassel. Grasses may be present but are less abundant than in other vegetation types. The most common are blue grama, side-oats grama, black grama and wolftail. On the poorer sites, three-awn and annual bromes may be common.

Pinyon Juniper Woodlands

Extensive stands of pinyon juniper woodlands occur in Yavapai County. Typical stands can be found north of Chino Valley, Ashfork, south of Seligman, and in much of the country between Sedona and Stoneman Lake. These woodlands often produce an under story of blue grama intermixed with side-oats grama, western wheatgrass, and tobosa. Winterfat, cliffrose, and silktassel may be locally abundant. As grass stands become thinner, weeds such as annual goldeneye and clubflower fill in the openings. Snakeweed and threadleaf groundsel may become common. In areas where the pinyon juniper canopy has closed, grasses and herbaceous plants become rare to nonexistent.

Montane Conifer Forest

Dense stands of ponderosa pine are found above 5,000 feet elevation where precipitation is greater than 16 inches per year. Other important trees include Gambel oak, Arizona walnut, aspen, Douglas fir, and white fir. Grasses may include blue grama, western wheatgrass, Arizona and sheep fescue, mountain and screwleaf muhly, junegrass, muttongrass, and dryland sedges. These areas are primarily used for summer range.

Riparian

A riparian area is a land and water interface. In the Southwest, riparian areas may have above-ground or below-ground flows of water. Above ground flows usually occur during the wet seasons of winter and the summer monsoons. Ephemeral or intermittent streams are the dominant stream type. Riparian areas are found at all elevation levels. The transition between riparian and arid regions are often abrupt transitions.

APPENDIX D

QUESTIONNAIRE

Wildfire Risk Reduction Actions in Prescott, Arizona

A study of homeowner's action in reducing the impacts of wildfire on life and property.

Please complete the questionnaire and return in the postage paid envelope provided when you are finished.

Questionnaire may also be completed on-line at http://goo.gl/ygMkCT

Thank you for your help!

Yavapaifirewise.org

Dear Homeowner,

This research study seeks to learn about homeowner wildfire risk reduction behaviors in Prescott, Arizona. The aim of this research is to help inform your community about the unique dynamics concerning this topic. The study is part of a requirement for the completion of a dissertation and is cooperatively being conducted by the Prescott Area Wildland Urban Interface Commission, National Fire Protection Association, United Service Automobile Association, and Arizona State University. You are one of a small number of people randomly chosen to represent homeowners in the Prescott, Arizona region, so your opinions are important to us. You must be 18 years of age or older to participate.

Your participation in this survey will remain confidential and at no time will your name be identified with any results. All the information collected will be used for statistical purposes. Your response to this request is completely voluntary and the completion of the survey is considered your consent to participate. Your participation in this study is of great interest to us and your local community.

The survey will take approximately 30 minutes to complete.

For the purpose of this study, we offer the following clarifications:

What are wildfire risk reduction actions?

These are action one can take to reduce the impact of a wildfire (if one were to threaten your property) on your property's house, personal belongings, and life. These actions include use of fire proofing material on structures and regular maintenance on the yard's vegetation. Below is a short list of some actions recommended by the Firewise Communities Program. For more information on wildfire risk reduction actions and local efforts to create a resilient community, please visit YavapaiFirewise.org.

Actions on house	Actions on vegetation
Install non-combustible roof & keep free of debris	Branches removed within 10 feet of roof
Close all outside gaps & place screens over vents	Green vegetated area maintained w/in 30 ft. of home
Install fire resistant siding	Lower tree branches removed to 12 feet
Install tempered double pane windows	Dead vegetation, leaves, & needles regularly cleared w/in 30 ft of home
Enclose openings under decks & porches	

If you have any questions about the survey, please feel free to contact Eric Steffey at Arizona State University by email WildfireMitigationStudy@asu.edu or by phone at (928) 275-2083.

This study is being conducted under the direction of Dr. Megha Budruk, Associate Professor, School of Community Resources and Development, Arizona State University. You can contact her by email Megha.Budruk@asu.edu or by phone at (602) 496-0171.

This study has been reviewed and approved by the Arizona State University Institutional Review Board. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Thank you!

The first section asks about your home ownership, property characteristics, and residency.

1. **How many days a year, on average, do you reside in the residence located in Prescott, Arizona? (*Please enter number of days*)**

   _____ Days

2. **How many years have you lived at/owned this property? (*Please enter number of years*)**

   _____ Years

3. **What type of housing unit is located on the property owned in Prescott, Arizona? (*please ✓one*)**

   ☐ Single family home ☐ Townhome ☐ Condominium

   ☐ Duplex, triplex, etc. ☐ Manufactured or mobile home

4. **How many stories is the home located on the parcel owned in Prescott, Arizona? (*please ✓one*)**

   ☐ 1 story ☐ 2 stories ☐ 3 or more stories

5. **What is the construction material of your home? (*please ✓one*)**

   ☐ Wood frame with vinyl siding ☐ Wood frame with wood siding

   ☐ Wood frame with stucco siding ☐ Wood frame with brick siding

   ☐ Wood frame with concrete siding ☐ Wood frame with metal siding

   ☐ Cinder block ☐ Concrete

6. **What type of roof is on the home? (*please ✓one*)**

   ☐ Cedar shake ☐ Asphalt shingles ☐ Metal ☐ Terra cotta tiles

7. **Has your homeowner's insurance company ever: (*please ✓one for each*)**

   Threatened to cancel your policy if wildfire risk reduction actions were not taken on your property?

   ☐ Yes ☐ No ☐ Not sure

   Provided incentives or discounts for taking wildfire risk reduction action on your property or for living in a registered Firewise Community?

   ☐ Yes ☐ No ☐ Not sure

8. **Is your home located in a neighborhood with an active Homeowner's Association? (*please ✓one*)**

   ☐ Yes ☐ No ☐ Not sure

   If yes, how would you rate the influence the association has on your actions concerning protecting your property from the risk of wildfire? *(Please circle one)*

   No influence 1 2 3 4 5 6 7 Much influence

This section asks about your personal experiences with and knowledge of wildfire.

9. How well informed do you consider yourself to be about wildfire risks to your property? (C*ircle one*)

Not at all informed 1 2 3 4 5 6 7 Very informed

10. To what extent do you find information about wildfires to be personally relevant? (C*ircle one*)

Not at all relevant 1 2 3 4 5 6 7 Very relevant

11. How motivated are you to learn more about the connection between wildfire risk and undertaking behaviors to create defensible space around your home? (C*ircle one*)

Not at all motivated 1 2 3 4 5 6 7 Very motivated

12. To understand impacts of wildfire events, please identify the year of your first and most recent experience for each of the following. Also, provide the number of times you have experienced that particular event. (*Please write in year and # of times experienced, if not experienced please write NA*)

Wildfire events	Year first experienced	Year most recently experienced	# of times experienced
Wildfire between 20 to 50 miles from property	_____	_____	_____
Wildfire between 10 to 20 miles from property	_____	_____	_____
Wildfire within 10 miles of property	_____	_____	_____
Prepared to evacuate property	_____	_____	_____
Evacuated property	_____	_____	_____
Home, structure, and/or property damaged	_____	_____	_____
Home, structure, and/or property destroyed	_____	_____	_____

This section asks about responsibility of risk reduction actions and your perceived risks.

13. To what extent do you feel concerned about the effects of wildfire? (*Circle one*)

Not at all concerned 1 2 3 4 5 6 7 Very concerned

14. How serious do you feel the negative consequences of wildfire are to you personally? (C*ircle one*)

Not at all serious 1 2 3 4 5 6 7 Extremely serious

15. How vulnerable do you feel about the possibility of wildfire physically affecting you or your family? (*Circle one*)

Not at all vulnerable 1 2 3 4 5 6 7 Extremely vulnerable

16. How vulnerable do you feel about the possibility of wildfire affecting your property and/or possessions? (*Circle one*)

Not at all vulnerable 1 2 3 4 5 6 7 Extremely vulnerable

17. How severe would the impact of a wildfire be where you live? (*Circle one*)

Not at all severe 1 2 3 4 5 6 7 Extremely severe

18. To what extent do you feel concerned about adjacent properties that have not taken wildfire risk reduction actions? (*Circle one*)

Not at all concerned 1 2 3 4 5 6 7 Very concerned

19. For protection of <u>your property and home</u> in the Prescott area, how responsible are each of the following in reducing wildfire risk? (*Please circle the level of responsibility for each*)

	Not at all responsible						**Very responsible**	
Myself	1	2	3	4	5	6	7	NA
My neighbors	1	2	3	4	5	6	7	NA
Homeowner association	1	2	3	4	5	6	7	NA
City of Prescott	1	2	3	4	5	6	7	NA
County of Yavapai	1	2	3	4	5	6	7	NA
State of Arizona	1	2	3	4	5	6	7	NA
Bureau of Land Management	1	2	3	4	5	6	7	NA
USDA Forest Service	1	2	3	4	5	6	7	NA

20. For overall protection of the <u>Prescott area</u>, how responsible are each of the following in reducing wildfire risk? (*Please circle the level of responsibility for each*)

	Not at all responsible						**Very responsible**	
Myself	1	2	3	4	5	6	7	NA
My neighbors	1	2	3	4	5	6	7	NA
Homeowner association	1	2	3	4	5	6	7	NA
City of Prescott	1	2	3	4	5	6	7	NA
County of Yavapai	1	2	3	4	5	6	7	NA
State of Arizona	1	2	3	4	5	6	7	NA
Bureau of Land Management	1	2	3	4	5	6	7	NA
USDA Forest Service	1	2	3	4	5	6	7	NA

21. The following list includes possible features of your home and actions that your household may have taken for the purpose of protecting your home from wildfires, or some other reason (e.g., yard beauty or protection from other natural hazards). (*For each feature and action below, please check the <u>one</u> box that best explains if or why your household <u>took</u> that <u>action</u>*)

	Not a feature of my home or property	Action is not necessary, as it existed when home was purchased	My household took this action primarily for wildfire safety reasons	My household took this action primarily for other reasons	Did not take action
Roof and rain gutters kept free of leaves, needles, and twigs	☐	☐	☐	☐	☐
Overhanging & dead branches are removed within 10 feet of roof	☐	☐	☐	☐	☐
Firewood & lumber are stacked at least 30 feet away from the home	☐	☐	☐	☐	☐
A green vegetated area is maintained at least 30 feet around the home	☐	☐	☐	☐	☐
Trees and shrubs are thinned within 30-50 feet from the home	☐	☐	☐	☐	☐
Shrubs & lower tree branches are removed	☐	☐	☐	☐	☐
Dead vegetation, leaves, & needles are cleared at least 30 feet from the home	☐	☐	☐	☐	☐
Home has fire-resistant roof (e.g. asphalt or metal)	☐	☐	☐	☐	☐
Home has screening installed on all vents	☐	☐	☐	☐	☐
Home construction material (e.g. siding & decks) are fire-resistant	☐	☐	☐	☐	☐
Underside of deck is enclosed to keep debris from collecting underneath	☐	☐	☐	☐	☐
Yard is landscaped with fire-resistant vegetation	☐	☐	☐	☐	☐

22. The following list includes possible features of your home and actions that your household could take in the next 12 months for the purpose of protecting your home from wildfires, or some other reason (e.g., yard beauty or protection from other natural hazards). (*For each feature and action below, please check the <u>one</u> box that best explains your household's <u>future intentions</u> to complete each action*)

	Not a feature of my home or property	Structural action is not necessary, as it was already completed	My household plans to take this action primarily for wildfire safety reasons	My household plans to take this action primarily for other reasons	My household does not plan to complete this action
Roof and rain gutters will be kept free of leaves, needles, and twigs	☐	NA	☐	☐	☐
Overhanging and dead branches will be removed within 10 feet of roof	☐	NA	☐	☐	☐
A green vegetated area will be maintained at least 30 feet around the home	☐	NA	☐	☐	☐
Trees and shrubs will be thinned out within 30-50 feet from the home	☐	NA	☐	☐	☐
Shrubs & lower tree branches are removed	☐	NA	☐	☐	☐
Dead vegetation, leaves, & needles will be cleared at least 30 feet from the home	☐	NA	☐	☐	☐
Firewood and lumber will be stacked at least 30 feet away from the home	☐	☐	☐	☐	☐
Home will have fire-resistant roof installed (e.g. asphalt or metal)	☐	☐	☐	☐	☐
Home will have screening installed on all vents	☐	☐	☐	☐	☐
Fire resistant construction materials will be installed on the home (e.g. siding, porches, & decks)	☐	☐	☐	☐	☐
Underside of deck will be enclosed to keep debris from collecting underneath	☐	☐	☐	☐	☐
Yard will be landscaped with fire-resistant vegetation	☐	☐	☐	☐	☐

This section asks questions about your attitudes, perception, and constraints.

23. Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months is: *(Please circle one for each)*

Harmful	1	2	3	4	5	6	7	Beneficial
Bad	1	2	3	4	5	6	7	Good
Worthless	1	2	3	4	5	6	7	Valuable
Foolish	1	2	3	4	5	6	7	Wise
Useless	1	2	3	4	5	6	7	Useful
Punishing	1	2	3	4	5	6	7	Rewarding
Unenjoyable	1	2	3	4	5	6	7	Enjoyable
Undesirable	1	2	3	4	5	6	7	Desirable
Unimportant	1	2	3	4	5	6	7	Important

24. Performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months will: *(Please circle the likelihood for each)*

	Unlikely						Likely
Give me a sense of security	1	2	3	4	5	6	7
Provide safety for my family	1	2	3	4	5	6	7
Protect my property value	1	2	3	4	5	6	7
Still provide privacy around my home	1	2	3	4	5	6	7
Come at a significant cost	1	2	3	4	5	6	7
Reduce my risk to wildfire's impacts	1	2	3	4	5	6	7
Protect my personal belongings	1	2	3	4	5	6	7
Improve property appearance	1	2	3	4	5	6	7
Not stop a fire from burning down home	1	2	3	4	5	6	7

25. For the following, please provide your evaluation of each. ***(Please circle your rating for each)***

	Bad						Good
A sense of security is	1	2	3	4	5	6	7
Protecting my family is	1	2	3	4	5	6	7
Protection of my property value is	1	2	3	4	5	6	7
Privacy around my home is	1	2	3	4	5	6	7
Significant cost for mitigation is	1	2	3	4	5	6	7
Reducing my risk to wildfire's impact is	1	2	3	4	5	6	7
Protection of my belongings is	1	2	3	4	5	6	7
Improving my property's appearance is	1	2	3	4	5	6	7
My home burning down is	1	2	3	4	5	6	7

26. Most people who are important to me think that ___ perform wildfire risk reduction actions on my property's vegetation and home. (*Please circle one*)

I should not 1 2 3 4 5 6 7 I should

27. Most people whose opinion I value would approve of my performing wildfire risk reduction activities on my property's vegetation and home. (*Please circle one*)

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

28. It is expected of me that I complete wildfire risk reduction actions on my property's vegetation and home every year. (*Please circle one*)

Definitely false 1 2 3 4 5 6 7 Definitely true

29. Most of the residents in my neighborhood with whom I am acquainted with have preformed risk reduction activities on their property's vegetation and home to minimize the threat of wildfire. (*Please circle one*)

Definitely false 1 2 3 4 5 6 7 Definitely true

30. The following provides a list of individuals or groups who may think you should or should not perform wildfire risk reduction actions on your property's vegetation and home in the next 12 months. For each, please provide what you believe <u>their level of agreement would be</u> to you completing risk reduction actions on your property. (*Please circle one for each*)

	Should not take action						Should take action
My neighbors think that I	1	2	3	4	5	6	7
My friends think that I	1	2	3	4	5	6	7
My family think that I	1	2	3	4	5	6	7
My homeowner association thinks that I (*leave blank if not applicable*)	1	2	3	4	5	6	7
The City of Prescott and/or Yavapai County thinks that I	1	2	3	4	5	6	7

31. When it comes to reducing my risk from wildfires, I want to do what: (*Please circle one for each*)

	Disagree						Agree
My neighbors think I should do	1	2	3	4	5	6	7
My friends think that I should do	1	2	3	4	5	6	7
My family think that I should do	1	2	3	4	5	6	7
My homeowner's association thinks that I should do (*leave blank if not applicable*)	1	2	3	4	5	6	7
The City of Prescott and/or Yavapai County thinks that I should do	1	2	3	4	5	6	7

32. The following is a list of individuals or groups that you might be associated with. For each, please provide <u>their likelihood of performing wildfire risk reduction actions</u> on their property's vegetation and home in the next 12 months. (*Please circle one for each*)

	Would not take action						Would take action
My neighbors	1	2	3	4	5	6	7
My friends	1	2	3	4	5	6	7
My family	1	2	3	4	5	6	7
Owners of undeveloped property	1	2	3	4	5	6	7
Full-time residents	1	2	3	4	5	6	7
Renters	1	2	3	4	5	6	7
Out of state property owners	1	2	3	4	5	6	7
Seasonal/part-time residents	1	2	3	4	5	6	7

33. When it comes to matters of reducing risks from wildfires, how much do you want to be like: (*Please circle one for each*)

	Not at all						Very much
Your neighbors	1	2	3	4	5	6	7
Your friends	1	2	3	4	5	6	7
Your family	1	2	3	4	5	6	7
Owners of undeveloped property	1	2	3	4	5	6	7
Full-time residents	1	2	3	4	5	6	7
Renters	1	2	3	4	5	6	7
Out of state property owners	1	2	3	4	5	6	7
Seasonal/part-time residents	1	2	3	4	5	6	7

34. For myself to complete wildfire risk reduction actions on my property's vegetation and home in the next 12 months is: (*Please circle one*)

Extremely difficult	1	2	3	4	5	6	7	Extremely easy

35. I am confident that if I wanted to I could complete wildfire risk reduction actions on my property's vegetation and home in the next 12 months. (*Please circle one*)

False	1	2	3	4	5	6	7	True

36. For me to complete wildfire risk reduction actions on my property's vegetation and home in the next 12 months is: (*Please circle one*)

Impossible	1	2	3	4	5	6	7	Possible

37. I feel in complete control over whether I perform wildfire risk reduction actions on my property's vegetation and home in the next 12 months. (*Please circle one*)

Definitely False	1	2	3	4	5	6	7	Definitely True

38. The number of events outside my control which could prevent me from performing wildfire risk reduction actions on my property's vegetation and home in the next 12 months are: (*Please circle one*)

Numerous	1	2	3	4	5	6	7	Very few

39. Many factors can aid or hinder our ability to perform wildfire risk reduction actions on our property's vegetation and home. For each of the following statements, please provide your level of agreement that the event would impact your ability to perform risk reduction action on your property's vegetation and home. ***(Please circle your level of agreement for each)***

	Disagree						Agree
Being physical fit would enable me to perform wildfire risk reduction actions.	1	2	3	4	5	6	7
A debilitating illness would make it difficult for me to perform wildfire risk reduction actions.	1	2	3	4	5	6	7
Living on a fixed income would make it difficult for me to perform wildfire risk reduction actions.	1	2	3	4	5	6	7
Having the knowledge on how to protect my property would enable me to perform wildfire risk reduction actions.	1	2	3	4	5	6	7
Daily obligations such as family and work make it difficult to find time to perform wildfire risk reduction actions.	1	2	3	4	5	6	7
Having the appropriate tools would enable me to perform wildfire risk reduction actions.	1	2	3	4	5	6	7

40. In the next 12 months I will: ***(Please circle your level of likelihood for each)***

	Unlikely						Likely
Be physically fit	1	2	3	4	5	6	7
Experience a debilitating illness	1	2	3	4	5	6	7
Be on a fixed income	1	2	3	4	5	6	7
Have the knowledge on how to perform risk reduction actions	1	2	3	4	5	6	7
Not have the time to perform risk reduction actions	1	2	3	4	5	6	7
Have the tools needed to perform risk reduction actions	1	2	3	4	5	6	7

The final section asks basic demographic questions about yourself.

41. What is your gender? (*Please ✓one box*)

☐ Male ☐ Female

42. What was the year of your birth? (*Please enter year*)

19 ____

43. Please indicate which race or ethnic background you identify with. (*Please ✓all that apply*)

☐ White ☐ Black or African American

☐ American Indian or Alaska Native ☐ Asian

☐ Hispanic or Latino ☐ Native Hawaiian or Other Pacific Islander

☐ Other race or ethnicity? (*please specify*) _____

44. What is your current annual household income? (*Please ✓one box*)

☐ Less than $15,000 ☐ $15,000 - $29,999 ☐ $30,000 - $44,999

☐ $45,000 - $59,999 ☐ $60,000 - $74,999 ☐ $75,000 - $89,999

☐ $90,000 - $104,999 ☐ $105,000 – $119,999 ☐ $120,000 or more

45. What is the highest degree or level of school completed? (*Please ✓one box*)

☐ No schooling ☐ Some high school ☐ High school diploma/GED

☐ Some college ☐ Associate's degree ☐ Bachelor's degree

☐ Master's degree ☐ Professional degree ☐ Doctorate degree

46. What is your current employment status? (*Please ✓one box*)

☐ Working full-time ☐ Working part-time ☐ Retired ☐ Unemployed

47. Are you serving or have you ever served in the military? (*Please ✓one box*)

☐ Yes➪ ☐ No

If yes, what is your current military status? (*Please ✓one box*)

☐ Active Duty ☐ Reserves ☐ Retired

48. Please tell us any additional thoughts you may have concerning wildfire risk reduction actions on your property. (*Please use the space below for your response*)

Thank you for your participation.

Your answers will be very helpful

If you have any questions, please contact:

Eric Steffey
411 N. Central Ave.
Suite 550
Phoenix, AZ 85004
(928) 275 - 2083
WildfireMitigationStudy@asu.edu

Participant Code

APPENDIX E

PARTICIPANT RECRUITMENT

INITIAL MAILING COVER LETTER

Dear Prescott Area Homeowner,

You have been selected to participate in a research study exploring homeowner wildfire risk reduction behaviors. You are among a select number of individuals in the Prescott area who represent area homeowners. Therefore, your participation in this study is very important.

This study is part of a requirement for the completion of my dissertation as an Arizona State University student under the guidance of Dr. Megha Budruk. The study is being conducted cooperatively by the Prescott Area Wildland Urban Interface Commission, National Fire Protection Association, United Service Automobile Association, and Arizona State University. The goal of the research is to understand local dynamics related to wildfire risk reduction actions. Information gained from the responses will inform local wildfire mitigation organizations and programs of resident needs.

The study entails the completion of a questionnaire. This may be done by either completing the enclosed paper questionnaire or completing the questionnaire on-line. If you decide to complete the paper questionnaire, fill out the questions, place in the enclosed postage paid business reply envelope and place in the mail.

To complete the questionnaire on-line:

1. Go to http://goo.gl/ygMkCT
2. Enter the five digit participant code located on the back of the enclosed questionnaire and click next
3. Review the informed consent page, click next to begin answering the questions

The questionnaire should take about 30 minutes to complete. Your responses are voluntary and will remain confidential. If you have any questions about this study of Prescott area homeowners, please contact me at WildfireMitigationStudy@asu.edu or by phone at (928) 275-2083. This study has been reviewed and approved by the Arizona State University Institutional Review Board, and if you have any questions about your rights as a participant in this study, you may contact them at research.integrity@asu.edu or by telephone at (480) 965-6788.

I look forward to your participation and input in this study.

Sincerely,

REMINDER POSTCARD

Arizona State University
Wildfire Mitigation Study
411 N. Central Ave. Ste. 550
Phoenix, AZ 85004
ASU School of Community Resources & Development
ARIZONA STATE UNIVERSITY

Mailing Label

Dear Homeowner,
A short time ago you were mailed a questionnaire seeking input on wildfire risk reduction activities. The information gathered from the questionnaire will help inform local organizations and programs of the area's needs related to this topic. Your feedback is very important to us and we would like to ensure your views are recorded in the final results. If you have already completed the questionnaire, please accept our thanks for your participation and disregard this reminder. If not, we would greatly appreciate it if you would do so today.

You can complete the paper questionnaire that was initially sent to you, returning it in the business reply envelope, or complete the on-line version.
To access the online questionnaire, please follow the instructions below:

1. Go to http://goo.gl/ygMkCT
2. Enter the 5 digit participant code.
3. Review the informed consent page
4. Follow the onscreen instruction to navigate through the questionnaire.

Participant Code

If you have any questions, comments, or concerns, please contact me by email at WildfireMitigationStudy@asu.edu
or by phone at (928) 275-2083.

NFPA FIREWISE ASU School of Community Resources & Development ARIZONA STATE UNIVERSITY

FINAL MAILING COVER LETTER

Dear Prescott Area Homeowner,

In early August we sent a questionnaire to your address that asked for you input about wildfire risk reduction actions concerning the property you own in Prescott Arizona. The information gathered from the questionnaire will help inform local organizations and programs of the area's needs related to this topic. Your feedback on this topic is very important to us and we would like to ensure your views are recorded in the final results. If you have already completed the questionnaire, please accept our thanks for your participation and disregard this follow up mailing. If not, we would greatly appreciate if you would do so today.

The questionnaire may be completed by either filling out the paper questionnaire and mailing it back in the enclosed postage paid business reply envelope or completing the questionnaire on-line.

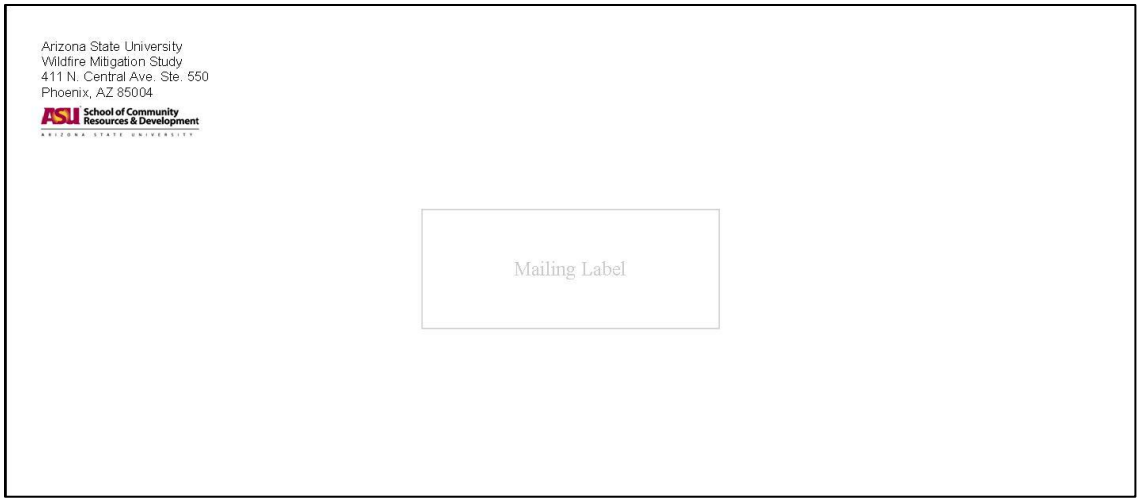
To complete the questionnaire on-line:
1. Go to http://goo.gl/ygMkCT
2. Enter the five digit participant code located on the back of the enclosed questionnaire and click next
3. Review the informed consent page, click next to begin answering the questions

The questionnaire should take about 30 minutes to complete. Your responses are voluntary and will remain confidential. If you have any questions about this study of Prescott area homeowners, please contact me at WildfireMitigationStudy@asu.edu or by phone at (928) 275-2083. This study has been reviewed and approved by the Arizona State University Institutional Review Board, and if you have any questions about your rights as a participant in this study, you may contact them at research.integrity@asu.edu or by telephone at (480) 965-6788.

I look forward to your participation and input in this study.

Sincerely,

ENVELOPE


Arizona State University
Wildfire Mitigation Study
411 N. Central Ave. Ste. 550
Phoenix, AZ 85004
ASU School of Community Resources & Development
Mailing Label

PRESS RELEASE

Contact:

Eric Steffey

Ph.D. Candidate, School of Community Resources and Development

Arizona State University, Phoenix, AZ 85004

(928) 275-2083

WildfireMitigationStudy@asu.edu

For Immediate Release (survey to be mailed on August 3rd, 2016 and again on August 22, 2016 to non-respondents); please run for a few weeks.

Research Study of Homeowner Wildfire Risk Reduction Actions

Homeowners of the Prescott area may receive mail from Arizona State University concerning a regional study of homeowner's wildfire risk reduction actions on their property. The study is focusing on those homeowners living in the Wildland-Urban Interface. The study is designed to learn more about what influences homeowners to take action in protecting life and property from wildfire. A random sample of homeowners was selected to receive a questionnaire that should take approximately 30 minutes to complete. Participation is voluntary but your input is important. All perspectives are needed so the data will accurately represent the opinions of area residents.

###

CORRESPONDENCE TO PRESCOTT CITY MAYOR

Eric Steffey, Ph.D. Candidate
411 N. Central Ave. Suite 550
Phoenix, AZ 85004

March 20, 2016

Mayor, Harry Oberg
City of Prescott, Arizona
201 S. Cortez
Prescott, AZ 86303

Mayor, Harry Oberg,

I am a doctoral student in the School of Community Resources and Development at Arizona State University and am writing to inform you of research planned for the Prescott area. Through my background of wildland firefighting, I am continuing my interests in protecting communities at risk of wildfire impacts through this study. The following is a brief overview of the study and its intended outcomes.

This dissertation, entitled *Predicting homeowner wildfire mitigation behaviors in the wildland urban interface* seeks to explore the dynamics of homeowner mitigation behaviors. The catalyst for exploring this area of research is due to the increase in wildfires that threaten communities, force evacuations, damage property, and causes loss of life. This is in part due to a century of failed wildfire policy creating unhealthy forests that pose high wildfire risks coupled with an influx of people moving to and living in these fire prone regions, also known as the wildland urban interface (WUI). National programs identify and promote effective wildfire mitigation actions to reduce wildfire risk; however, many homeowners do not perform these actions.

This study seeks to identify the factors that influence and/or limit homeowners' wildfire mitigation behaviors. Based on previous literature and using the theory of planned behavior as a theoretical foundation, the study proposes an integrated wildfire mitigation model to assess homeowner mitigation behaviors. The purpose of the study is to a) test if the Theory of Planned Behavior provides a valid predictive model for understanding homeowner wildfire mitigation behaviors, b) develop and empirically test an integrated wildfire mitigation model, and c) explore the role of homeowner associations (HOA) on wildfire mitigation behaviors.

The population for the study is homeowners with property in the WUI located in the Prescott area in central Arizona. The study will sample two groups, homeowners with

property in an HOA and those not in an HOA. Data collection is planned for mid April through July 2016. Participants will be randomly selected from the population with recruitment through postal mail. Responses will be gathered through a questionnaire that can be completed either on-line or through paper form. The study seeks to develop a theoretical framework to identify site specific factors in explaining wildfire mitigation behaviors to help inform local programs and policy. In addition to the dissertation, reports of these data will be created and provided to the City of Prescott, Yavapai County, and the Prescott Area Wildland Urban Interface Commission (PAWUIC). The study findings will be presented to PAWUIC and other venues as requested.

Though this research is being conducted to complete the requirements of a doctoral program, the data gather is of importance to the communities studied. My overarching goal with this research is to provide information and tools to local municipalities and organizations to help inform the development of programs and policies in creating more resilient communities. For more information, questions, or comments, please contact me by email at Eric.Steffey@asu.edu or by phone at (904) 553-3295.

Sincerely,

Eric Steffey

CORRESPONDENCE TO YAVAPAI COUNTY BOARD SUPERVISOR

Eric Steffey, Ph.D. Candidate
411 N. Central Ave. Suite 550
Phoenix, AZ 85004

March 20, 2016

Chairman, Jack Smith
Yavapai County Board of Supervisors
1015 Fair Street
Prescott, AZ 86305

Chairman, Jack Smith,

I am a doctoral student in the School of Community Resources and Development at Arizona State University and am writing to inform you of research planned for the Prescott area. Through my background of wildland firefighting, I am continuing my interests in protecting communities at risk of wildfire impacts through this study. The following is a brief overview of the study and its intended outcomes.

This dissertation, entitled *Predicting homeowner wildfire mitigation behaviors in the wildland urban interface* seeks to explore the dynamics of homeowner mitigation behaviors. The catalyst for exploring this area of research is due to the increase in wildfires that threaten communities, force evacuations, damage property, and causes loss of life. This is in part due to a century of failed wildfire policy creating unhealthy forests that pose high wildfire risks coupled with an influx of people moving to and living in these fire prone regions, also known as the wildland urban interface (WUI). National programs identify and promote effective wildfire mitigation actions to reduce wildfire risk; however, many homeowners do not perform these actions.

This study seeks to identify the factors that influence and/or limit homeowners' wildfire mitigation behaviors. Based on previous literature and using the theory of planned behavior as a theoretical foundation, the study proposes an integrated wildfire mitigation model to assess homeowner mitigation behaviors. The purpose of the study is to a) test if the Theory of Planned Behavior provides a valid predictive model for understanding homeowner wildfire mitigation behaviors, b) develop and empirically test an integrated wildfire mitigation model, and c) explore the role of homeowner associations (HOA) on wildfire mitigation behaviors.

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property in an HOA and those not in an HOA. Data collection is planned for mid April through July 2016. Participants will be randomly selected from the population with recruitment through postal mail. Responses will be gathered through a questionnaire that can be completed either on-line or through paper form. The study seeks to develop a theoretical framework to identify site specific factors in explaining wildfire mitigation behaviors to help inform local programs and policy. In addition to the dissertation, reports of these data will be created and provided to the City of Prescott, Yavapai County, and the Prescott Area Wildland Urban Interface Commission (PAWUIC). The study findings will be presented to PAWUIC and other venues as requested.

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Sincerely,

Eric Steffey

courier.com Sunday • August 14, 2016 PAGE 1C

ON YOUR

PROPERTY

Why do some people reduce wildfire risk and others do nothing?

Doctoral student studying Prescott residents who take – or don't take – action

By SUE TONE
The Daily Courier
stone@prescottaz.com

One would think homeowners would not want wildfires sweeping through their neighborhoods and burning up their properties. Already, in and around Prescott, 32 communities have taken fuel mitigation action to protect their properties, and by doing so, have earned certification through the FireWise Communities organization.

But other homeowners choose not to clear back thick brush, or limit vegetation close to their homes. Eric Steffey, a doctoral candidate at Arizona State University (ASU), wants to find out why.

Steffey is conducting a study that focuses on homeowners living in what's called the Wildland-Urban Interface. He hopes to determine what factors influence homeowners to protect their property and lives from wildfire, and what prohibits that from happening.


Steffey

Steffey is mailing out a survey this week to a random number of homeowners. The survey takes about 30 minutes to fill out, and all responses are confidential, no information is linked back to individuals, residences or even to neighborhoods. The return address on the envelope designates the Wildfire Mitigation Study with an ASU logo.

Steffey is investigating attitude, social norms and constraints. If attitude is an issue, how can municipalities change that – perhaps with programs to better explain mitigation work?

If social norms are a factor – "Well, my friends and family think I shouldn't, so I won't; or they think I should, so I will; or my neighbors aren't, so I won't" – and influence people's actions or lack of actions.

The third element, perceived constraints, could be monetary, physical or based on knowledge. Some elderly people can't get out and do the work, or pay someone else to. Other factors that might affect homeowners' decisions is a belief in wildfire risk, whether they are fulltime or seasonal residents, the size of the lot and amount of vegetation, and if there is a Home Owners Association and its influence on the issue.

"If someone doesn't perceive a risk, they're probably not going to make mitigation a priority. Prescott seems to have a lot of awareness, but that could be different in other areas," Steffey told an audience at a Prescott Area Urban Wildfire Interface Commission (PAUWIC) meeting earlier this year.

His interest came from his work as a wildland firefighter in Florida. "It always fascinated me that some homeowners don't mitigate. It kind of inspired me to pursue this line of inquiry," he said, adding that anticipates a 30-35 percent response rate to the survey.

Prescott is a model city, yet there are still people who don't mitigate, even with all the awareness.

"The ultimate goal is for everyone to do their part so the community itself becomes resilient. You can do everything on your property to mitigate the effects of wildfire, but if your neighbor next to you does nothing, your neighbor puts you at higher risk," he said.

Once the data is in, Steffey will send a report to the PAUWIC, Prescott, Yavapai County and others interested in the results.

"I don't want to just do it for my dissertation and be done with it. I want to have changed the communities. I want to disseminate this information out there," he said. "It's not just some outside firm or somebody dong random research. It's really intended for Prescott."

Courtesy Photo

Manzanita Village became a FireWise Community in 2011 and participates in the annual Wildfire Community Preparedness Day.

> The ultimate goal is for everyone to do their part so the community itself becomes resilient. You can do everything on your property to mitigate the effects of wildfire, but if your neighbor next to you does nothing, your neighbor puts you at higher risk.
> – Eric Steffey

Follow Sue Tone on Twitter @ToneNotes. Reach her at 928-445-3333 ext. 2043 or 928-642-7867.

A random number of area homeowners should expect to receive a survey in the mail soon. The survey takes about 30 minutes to fill out, and all responses are confidential, no information is linked back to individuals, residences or even to neighborhoods. The return address on the envelope designates the Wildfire Mitigation Study with an ASU – logo.

Courtesy image

APPENDIX F

GIS FLOW CHART

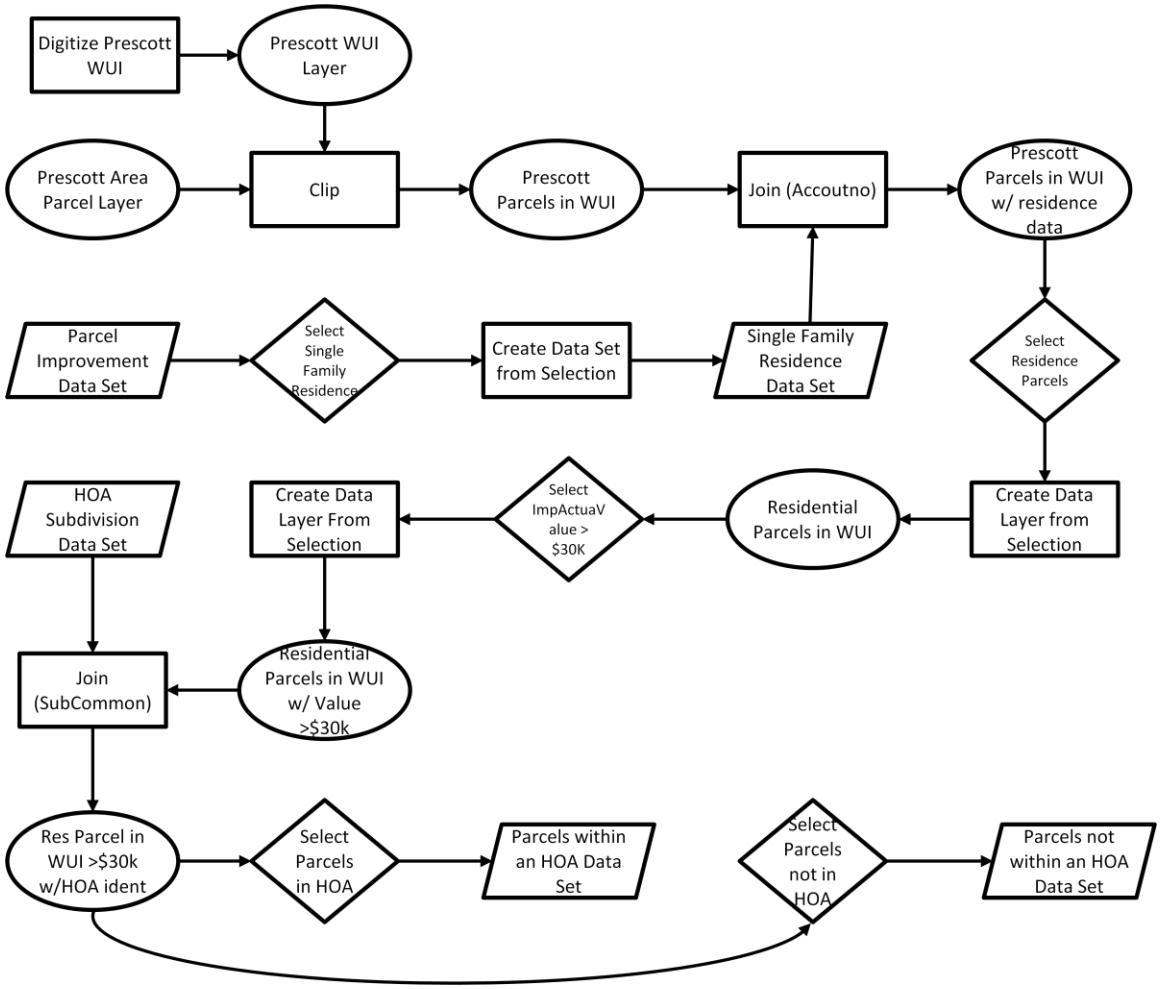

Figure 12 GIS Flow Chart

APPENDIX G

DISSERTATION RESEARCH TIMELINE FOR COMPLETION

Proposed Date	Task	Completed Date	
2/2/2015	Submit comp packet to committee	Completed	2/24/2015
2/2/2015	Schedule Comprehensive exam date	Completed	3/2/2015
3/2/ - 3/16/2015	Written comprehensive exam	Completed	3/20/2015
3/16/ - 4/3/2015	Oral comprehensive exams	Passed	3/31/2015
4/1/2015-On going	Develop contacts	On-going	
8/10/2015	Create key informant interview script	Completed	9/7/2015
8/10/2015	Create informed consent form	Completed	9/7/2015
8/31/2015	Interview IRB application for exempt Status	Granted	9/14/2015
8/31/2015	Schedule interviews	Completed	10/9/2015
9/15/ - 10/15/15	Conduct interviews	Completed	10/13/2015
10/15/ - 11/30/15	Analyze key informant interview data	Completed	11/30/2015
9/15/ - 12/28/2015	Proposal Review	Completed	1/20/16
1/4/2016	Finalize proposal	Completed	1/30/16
1/4/2016	Schedule date for proposal defense	Completed	2/2/16
1/4/2016	Send proposal to committee	Completed	1/30/16
1/18/ - 1/29/16	Proposal defense	Passed	2/15/2016
1/22/2016	Create Questionnaire	Completed	3/18/2016
1/22/2016	Create informed consent form for study	Part of Questionnaire	
1/22/2016	Create notification letter	Part of Questionnaire	
1/22/2016	Create initial postcard mailing	Completed	3/18/2016
1/22/2016	Create reminder mailing	Completed	3/18/2016
1/22/2016	Create final mailing letter	Completed	3/23/2016
2/19/2016	Set up university expenditure account	Unable w/out ext funds	
2/19/2016	Request revised parcel data layer	Received	3/10/2016
2/25/2016	Send request for Prescott Council meeting	Sent	3/24/2016
3/24/2016	Send revised questionnaire to Committee	Sent	3/24/2016
3/1/2016	Create press release for Prescott papers	Completed	3/23/2016
3/1/2016	Pilot Study IRB application for exempt status	Granted	3/24/2016
4/1/2016	Send questionnaire to PAWUIC	Completed	4/4/2016
3/3/2016	Present research to PAWUIC	Completed	3/3/2016
3/15/2016	Finalize postcards and mailings	Completed	3/24/2016
3/15 /2016	Present research to Prescott & Yavapai	Sent info	3/28/2016
4/11/2016	Print pilot study material	Completed	4/26/2016
4/16/-4/25/16	Run press release in local paper	Running	5/1 - 5/14
NA	Send Prenotification letter/postcard to pilot study sample	Removed	
4/18/2016	Send initial postcard to pilot study sample	Sent	4/29/2016
4/25/2016	Send reminder postcard	Sent	5/13/2016

5/2/2016	Send final mailing	Sent	5/20/2016
5/9/ - 5/23/2016	Enter, clean, and analyze pilot study data	Completed	6/21/2016
5/16/2016	Revise Questionnaire for main study	Completed	6/22/2016
5/18/2016	Send revised questionnaire to committee	Sent	6/27/2016
5/25/2016	Send questionnaire to PAWUIC, NFPA, & USAA	Sent	7/6/2016
6/1/2016	Submit IRB for main study exempt status	Granted	7/20/2016
6/3/2016	Print main study material	Completed	8/4/2016
6/3/2016	Send media releases to news outlets	Sent	8/2/2016
NA	Send prenotification	Removed	
6/6/2016	Send initial mailing to main study sample	Sent	8/8/2016
6/13/2016	Send reminder postcard to main study sample	Sent	8/15/2016
6/27/2016	Send final mailing to main study sample	Sent	8/22/2016
7/11/2016	Conduct non-response study	Not Conducted	
6/27/ - 7/11/2016	Enter, clean, and analyze data	Completed	10/10/2016
7/11/-7/31/2016	Draft results chapter	Completed	10/16/2016
7/31/2016	Send results for review	Sent	10/16/2016
7/18/-8/15/2016	Draft discussion chapter	Sent	10/23/2016
8/15/2016	Send discussion for review	Sent	10/24/2016
8/15/-9/12/2016	Finalize dissertation	Completed	10/25/2016
9/12/2016	Send dissertation for review	Completed	10/25/2016
9/26/2016	Send dissertation for review to committee	Completed	10/25/2016
9/26/-10/3/2016	Schedule dissertation defense	Completed	9/28/2016
10/3/2016	Deadline to apply for graduation	Applied	9/29/2016
10/24/-10/28/2016	Dissertation defense	Completed	11/8/2016
10/26/2016	Last day to schedule oral defense	Completed	9/29/2016
11/9/2016	Last day to hold an oral defense	----------	
11/9/2016	Submit survey of earned doctorates	Submitted	9/29/2016
11/14/2016	Dissertation revisions & submission	Submitted	11/14/2016
11/17/2016	Submit final dissertation revisions	Submitted	11/17/2016
11/17/2016	Submit dissertation pass/fail form.	Submitted	11/9/2016
11/28/2016	Submit dissertation to ProQuest by 2 p.m.	Submitted	11/28/2016

APPENDIX H

IRB APPLICATIONS AND EXEMPTION APPROVALS

IRB APPLICATION FOR KEY INFORMANT INTERVIEWS

Instructions and Notes:

Depending on the nature of what you are doing, some sections may not be applicable to your research. If so, mark as "NA".

When you write a protocol, keep an electronic copy. You will need a copy if it is necessary to make changes.

Protocol Title

Include the full protocol title:

Prescott Neighborhood Firewise Study

Background and Objectives

Provide the scientific or scholarly background for, rationale for, and significance of the research based on the existing literature and how will it add to existing knowledge.

Describe the purpose of the study.

Describe any relevant preliminary data.

The purpose of this study is to understand the unique dynamics which are involved in homeowner's mitigation behaviors in the Wildland Urban Interface (WUI). This is an initial stage of dissertation research to gain a base of knowledge of the neighborhoods of interest.

The population studied will be prominent residents and neighborhood leaders in the Prescott area. As the research will be focused on homeowners and homeowner associations, persons 18 years of age and older are the intended population of the study.

Key informant interviews will be conducted to gain insight into neighborhood dynamics.

The interviews will be focused on neighborhood demographics, physical characteristics of the structures and surrounding vegetation, and homeowner behaviors as they relate to wildfire mitigation on personal property.

The full key informant script (file #1 "Key Informant Script") is included in this IRB application.

Inclusion and Exclusion Criteria

Describe the criteria that define who will be included or excluded in your final study sample. If you are conducting data analysis only describe what is included in the dataset you propose to use.

Indicate specifically whether you will target or exclude each of the following special populations:

Minors (individuals who are under the age of 18)

Adults who are unable to consent

Pregnant women

Prisoners

Native Americans

Undocumented individuals

Participants in the sample for this study will only be homeowners (adults) who are 18 years of age and older and who currently reside in select neighborhoods in the Prescott area. These are neighborhoods located in the Wildland Urban Interface or could potentially be threatened by wildfire.

This study will not include adults who are unable to consent to the study, minors, or prisoners. We will also not be targeting pregnant women, Native Americans, undocumented individuals, or other recognized vulnerable populations.

Number of Participant

Indicate the total number of participants to be recruited and enrolled*:*

Up to 12 neighborhoods will be identified with one key informant from each being asked to participate.

Recruitment Methods

Describe when, where, and how potential participants will be identified and recruited.

Describe materials that will be used to recruit participants. (Attach copies of these documents with the application.)

Participants will be identified and recruited through connections with the Prescott Area Wildland Urban Interface Commission (PAWUIC). PAWUIC is a grass roots organization that was formed by many local neighborhoods to promote firewise mitigation after the Dose fire threatened the area and a loss of 6 firefighters during the Dude fire in 1990. This commission continues to be a strong advocate for wildland mitigation in the area with many neighborhoods involved. PAWUIC has provided contact information of its neighborhood members/leaders. This information will used to contact (via phone or email) individuals to identify interest and willingness to participate in the interview. Interviews are planned to be conducted between September 15th through October 15th. The recruitment letter that will be read/sent is attached, see (File #2, "Informed Consent Form")

Procedures Involved

Describe all research procedures being performed and when they are performed. Describe procedures including:

Surveys or questionnaires that will be administered. (Attach all surveys, interview questions, scripts, data collection forms, and instructions for participants.)

What data will be collected including long-term follow-up?

Lab procedure and tests and related instructions to participants

The period of time for the collection of data.

Describe the amount and timing of any compensation or credit to participants.

If the research involves conducting data analysis only, describe the data that that will be analyzed.

Between September 15th and October 15th, key informant interviews will be conducted.

Interviews will be recorded on a digital recording devise for transcription of the interview.

These interviews will be a onetime event with no follow up interviews to be completed.

The research team will analyze the data by October 31.

No lab procedures and tests are planned.

We estimate that the key informant interviews will range from 45" to 1 hour and 30".

Compensation to participants will not be offered.

Risks to Participants

List the reasonably foreseeable risks, discomforts, or inconveniences related to participation in the research. Consider physical, psychological, social, legal, and economic risks.

The research team does not anticipate that the study participants will incur physical, psychological, social, legal, or economic harm during their participation in this study. We will, however, be sensitive to and will promptly reply to any concerns raised by participants.

Participation in the study is absolutely voluntary.

In order to reduce any risks of the study, participants may decide to skip any of the questions or leave/withdraw from the study at any time.

Potential Benefits to Participants

Realistically describe the potential benefits that individual participants may experience from taking part in the research. Indicate if there is no direct benefit. Do not include benefits to society or others.

The participants will benefit from this study directly by identifying the dynamics involved with individual neighborhoods and the greater Prescott area. This better understanding will allow the neighborhoods to focus resources in those critical areas of need.

Prior Approvals

Describe any approvals – other than the IRB - that will be obtained prior to commencing the research. (e.g., school, external site, or funding agency approval.)

Our research team will seek no other approvals at this time. Prior approvals have already been ascertained from PAWUIC for partnership in this study.

Privacy and Confidentiality

Describe the steps that will be taken to protect subjects' privacy interests. "Privacy interest" refers to a person's desire to place limits on with whom they interact or to whom they provide personal information.

Describe the following measures to ensure the confidentiality of data:

Where and how data will be stored?

How long the data will be stored?

Who will have access to the data?

Describe the steps that will be taken to secure the data (e.g., training, authorization of access, password protection, encryption, physical controls, certificates of confidentiality, and separation of identifiers and data) during storage, use, and

transmission.

In order to protect privacy interests of research participants, we will not be requesting participants to provide personal identifiers in their answers.

The data will be stored for 3 years.

Data will be stored on a password-protected computer to be maintained by one member of the research team. Only PIs and the Co-PIs listed in this application will have access to the data.

Participation in the study is absolutely voluntary.

In order to reduce risks of the study, participants may decide to skip any of the questions or leave/withdraw from the study at any time.

Consent Process

Indicate the process you will use to obtain consent. Include a description of:

Where will the consent process take place

How will consent be obtained

Non-English Speaking Participants

Indicate what language(s) other than English are understood by prospective participants or representatives.

If participants who do not speak English will be enrolled, describe the process to ensure that the oral and/or written information provided to those participants will be in that language. Indicate the language that will be used by those obtaining consent.

Waiver or Alteration of Consent Process (written consent will not be obtained, required information will not be disclosed, or the research involves deception)

Review the "CHECKLIST: Waiver or Alteration of Consent Process (HRP-410)" to ensure you have

provided sufficient information for the IRB to make these determinations.

Participants who are minors (individuals who are under 18)

Describe the criteria that will be used to determine whether a prospective participant has not attained the legal age for consent to treatments or procedures involved in the research under the applicable law of the jurisdiction in which the research will be conducted.

The consent process will take place at the time of the interview. Before proceeding with the interview, participants will be asked to read the consent form. The participant will signify their wish to participate in the study after reading the form by proceeding with the interview (see file "Informed Consent Form").

Non-English speakers will not be part of the study sample. Translation services are not available for the study.

All participants will be 18 years of age or older.

The interviews will be recorded on a digital recording device but participant can chose to opt out of the recording at any time.

Process to Document Consent in Writing

If your research presents no more than minimal risk of harm to participants and involves no procedures for which written documentation of consent is normally required outside of the research context, the IRB will consider a waiver of the requirement to obtain written documentation of consent.

(If you will document consent in writing, attach a consent document. If you will obtain consent, but not document consent in writing, attach the short form consent template or describe the procedure for obtaining and documenting consent orally.)

Key informant interviews will have a consent letter (see file "Informed Consent

Form") which the participants will need to read in order to participate.

Training

Provide the date(s) the members of the research team have completed the CITI training for human participants. This training must be taken within the last 3 years. Additional information can be found at: http://researchintegrity.asu.edu/training/humans

Name	Role	Date of Training Completion
Megha Budruk	PI	07/03/2013
Eric Steffey	Co-PI	10/11/2012

IRB EXEMPTION LETTER FOR KEY INFORMANT INTERVIEWS

EXEMPTION GRANTED

Megha Budruk
Community Resources and Development, School of
602/496-0171
Megha.Budruk@asu.edu
Dear Megha Budruk:
On 9/14/2015 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Prescott Neighborhood Friewise Study
Investigator:	Megha Budruk
IRB ID:	STUDY00003153
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Key Informant Script, Category: Recruitment Materials; • HRP-503a Study Application, Category: IRB Protocol; • Informed Consent Form, Category: Consent Form;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 9/14/2015.
In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).
Sincerely,
IRB Administrator
cc: Eric Steffey
Eric Steffey

IRB APPLICATION FOR PILOT STUDY

Instructions and Notes:

- Depending on the nature of what you are doing, some sections may not be applicable to your research. If so, mark as "NA".
- When you write a protocol, keep an electronic copy. You will need a copy if it is necessary to make changes.

1 Protocol Title

Include the full protocol title: *Predicting homeowner wildfire mitigation behaviors in the Wildland-Urban Interface Pilot Study*

2 **Background and Objectives**

Provide the scientific or scholarly background for, rationale for, and significance of the research based on the existing literature and how will it add to existing knowledge.

- Describe the purpose of the study.
- Describe any relevant preliminary data or case studies.
- Describe any past studies that are in conjunction to this study.

Increasingly, wildfires are threatening communities, forcing evacuations, damaging property, and causing loss of life. This is in part due to a century of failed wildfire policy and an influx of people moving to the wildland urban interface (WUI). National programs have identified and promoted effective wildfire mitigation actions to reduce wildfire risk; however, many homeowners do not perform these actions.

This study seeks to identify the factors that influence and/or limit homeowners' wildfire mitigation behaviors. Based on previous literature and using the theory of planned behavior as a theoretical foundation, the study proposes an integrated wildfire mitigation model to assess homeowner mitigation behaviors.

The purpose of the study is to a) test the validity of the theory of planned behavior as a foundational model in exploring wildfire mitigation behaviors, b) develop and empirically test a wildfire mitigation model, and c) explore the role of homeowner associations (HOA) on wildfire mitigation behaviors.

Data gathered from the Prescott Neighborhood Firewise Study (STUDY00003153) was used in the development of study questions and aims. This current submission is for a pilot study which will test the methods and validate questions used for the main study to be conducted after pilot study is complete. A new IRB application will be submitted for the main study.

3 Data Use

Describe how the data will be used.
Examples include:

- Dissertation, Thesis, Undergraduate honors project
- Publication/journal article, conferences/presentations
- Results released to agency or organization
- Results released to participants/parents
- Results released to employer or school
- Other (describe)

The data collected will be used in completing the requirements of a dissertation. Data will also be presented in oral and report form to the Prescott Area Wildland Urban Interface Commission, Yavapai County, and the City of Prescott. Data collected will also be used in publications, journal articles, and conference presentations.

4 Inclusion and Exclusion Criteria

Describe the criteria that define who will be included or excluded in your final study sample. If you are conducting data analysis only describe what is included in the dataset you propose to use.
Indicate specifically whether you will target or exclude each of the following special populations:

- Minors (individuals who are under the age of 18)
- Adults who are unable to consent
- Pregnant women
- Prisoners
- Native Americans
- Undocumented individuals

The population being studied is owners, 18 years or older, of single family homes in and around the city of Prescott, Arizona that are located within the Wildland Urban Interface. To provide for later analysis of HOAs' impact on wildfire mitigation behaviors, the study will employ cluster sampling to account for equal representation of participants who own property in neighborhoods with and without an HOA. Participants in each cluster will be randomly selected based on these neighborhood level characteristics.

Due to the nature of focusing on home ownership, the study will inherently not include any minors or adults who are unable to consent. The study does not target any specific protected population such as pregnant woman, prisoners, Native Americans, or undocumented individuals. Though if a member of said groups owns a home in the study region, they could be part of the study representing the population.

5 Number of Participants

Indicate the total number of participants to be recruited and enrolled*:* 1,100

6 Recruitment Methods

- Describe who will be doing the recruitment of participants.
- Describe when, where, and how potential participants will be identified and recruited.
- Describe and attach materials that will be used to recruit participants (attach documents or recruitment script with the application).

The researchers of the study will be involved with recruiting. The study will develop the population lists through GIS and recruiting through postal mail.

Sample development: The sample is specific to the Prescott area with unique neighborhood level characteristics needed. To gain the detailed level needed, researchers have worked with Yavapai County GIS Department for access to parcel data layers. Through this and other data layers, a population of homeowners within the study region within the Wildland Urban Interface can be identified. Slitting the population into two groups of within a homeowners association and not in an association provides the two population of study. Each population list will be randomly selected from for an initial sample of 1,050 from each.

Recruitment: Recruitment will be through the form of postal mailing using a modified Dillman's method. The first mailing will be a postcard giving a brief description of their selection to participate and short synopsis of the study. The initial postcard will also have information on how to access the online-questionnaire with a unique participant code and a detachable portion to be mailed back to request a paper questionnaire (please see attached document "Initial Postcard"). A reminder postcard will be sent a week later to those who have not completed the questionnaire (please see attached document "Reminder Postcard"). A final mailing will be sent a week later to those who have not completed the questionnaire. This mailing will include the paper questionnaire.

7 Procedures Involved

Describe all research procedures being performed, who will facilitate the procedures, and when they will be performed. Describe procedures including:

- The duration of time participants will spend in each research activity.
- The period or span of time for the collection of data, and any long term follow up.
- Surveys or questionnaires that will be administered (Attach all surveys, interview questions, scripts, data collection forms, and instructions for participants to the online application).
- Interventions and sessions (Attach supplemental materials to the online application).
- Lab procedures and tests and related instructions to participants.
- Video or audio recordings of participants.
- Previously collected data sets that that will be analyzed and identify the data source (Attach data use agreement(s) to the online application).

A questionnaire instrument will be used to collect participant responses. The study will implement an on-line and paper option for the questionnaire. Each participant will be provided a unique participant code to be entered into the on-line system. This code will also be placed on any paper questionnaires mailed to the participant. This code is to track who has responded and to identify any issues with repeat responses. The address and participant code database will be kept in a separate encrypted file from the participant response database on a password protected computer to limit any ability to link the two. Participant responses will be kept confidential.

The questionnaire will take participants about 30 to 45 minutes to complete.

The pilot study will collect data from April 18th, 2016 through May 15th, 2016.

Please see attached document "Questionnaire" for the questions that will be addressed in the study.

The study does not currently have any outside funding and costs incurred will be paid by the Co-PI's personal funds.

8 Compensation or Credit

- **Describe the amount and timing of any compensation or credit to participants.**
- **Identify the source of the funds to compensate participants**
- **Justify that the amount given to participants is reasonable.**
- **If participants are receiving course credit for participating in research, alternative assignments need to be put in place to avoid coercion.**

The study will not be providing any compensation or credit.

9 Risk to Participants

List the reasonably foreseeable risks, discomforts, or inconveniences related to participation in the research. Consider physical, psychological, social, legal, and economic risks.

The research team does not anticipate that the study participants will incur physical, psychological, social, legal, or economic harm during their participation in this study.

Participation in the study is absolutely voluntary and participants may decide to skip any of the questions or leave/withdraw from the study at any time.

10 Potential Benefits to Participants

Realistically describe the potential benefits that individual participants may experience from taking part in the research. Indicate if there is no direct benefit. Do **not** include benefits to society or others.

The participants will benefit from this study directly by identifying the dynamics involved with individual neighborhoods and the greater Prescott area. This better understanding will allow the neighborhoods to focus resources in those critical areas of need. In addition, the questionnaire will act as an informational tool to help inform homeowners of mitigation actions that can be taken to reduce their risk from wildfire as well as places to get more information.

11 Privacy and Confidentiality

Describe the steps that will be taken to protect subjects' privacy interests. "Privacy interest" refers to a person's desire to place limits on with whom they interact or to whom they provide personal information. Click here for additional guidance on ASU Data Storage Guidelines.

Describe the following measures to ensure the confidentiality of data:

- Who will have access to the data?
- Where and how data will be stored (e.g. ASU secure server, ASU cloud storage, filing cabinets, etc.)?
- How long the data will be stored?
- Describe the steps that will be taken to secure the data during storage, use, and transmission. (e.g., training, authorization of access, password protection, encryption, physical controls, certificates of confidentiality, and separation of identifiers and data, etc.).
- If applicable, how will audio or video recordings will be managed and secured. Add the duration of time these recordings will be kept.
- If applicable, how will the consent, assent, and/or parental permission forms be secured. These forms should separate from the rest of the study data. Add the duration of time these forms will be kept.
- If applicable, describe how data will be linked or tracked (e.g. masterlist, contact list, reproducible participant ID, randomized ID, etc.).

If your study has previously collected data sets, describe who will be responsible for data security and monitoring.

Only the PI and Co-investigator listed in this application will have access to the data.

Data will be stored on a password-protected computer to be maintained by one member of the research team.

Paper questionnaires and data results will be kept in a locked cabinet.

All electronic data will be kept in encrypted folders.

Participants will be given a unique participant code to track if they have responded.

Participant information connected to the participant code will be kept in a separate encrypted folder from the responses ensuring confidentiality.

Data will be stored for 5 years.

Data from the Prescott Neighborhood Firewise Study (STUDY00003153) is and will be maintained by the Co-PI.

12 Consent Process

Describe the process and procedures process you will use to obtain consent. Include a description of:

- Who will be responsible for consenting participants?
- Where will the consent process take place?
- How will consent be obtained?
- If participants who do not speak English will be enrolled, describe the process to ensure that the oral and/or written information provided to those participants will be in that language. Indicate the language that will be used by those obtaining consent. Translated consent forms should be submitted after the English is approved.

Consent is obtained by the participant through their completion of the questionnaire. Described on the cover page of the questionnaire, participation in the Study is confidential and that its completion is voluntary. Please see attachment "Questionnaire" for the cover page.

13 Training

Provide the date(s) the members of the research team have completed the CITI training for human participants. This training must be taken within the last 4 years. Additional information can be found at: Training.

PI - Megha Budruk Ph.D. 8/11/2012
Co-PI Eric Steffey 10/11/2012

IRB EXEMPTION LETTER FOR PILOT STUDY

EXEMPTION GRANTED

Megha Budruk
Community Resources and Development, School of
602/496-0171
Megha.Budruk@asu.edu

Dear Megha Budruk:

On 3/24/2016 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Predicting homeowner wildfire mitigation behaviors in the Wildland-Urban Interface Pilot Study
Investigator:	Megha Budruk
IRB ID:	STUDY00004151
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Reminder Postcard, Category: Recruitment Materials; • Initial Recruitment Postcard, Category: Recruitment Materials; • Cover Letter for Final Mailing , Category: Recruitment Materials; • Press Release, Category: Recruitment Materials; • Questionnaire, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • HRP-503a-TEMPLATE_PROTOCOL_SocialBehavioralV02-10-15.docx, Category: IRB Protocol;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 3/24/2016.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator
cc: Eric Steffey

IRB APPLICATION FOR MAIN STUDY

Instructions and Notes:

- Depending on the nature of what you are doing, some sections may not be applicable to your research. If so, mark as "NA".
- When you write a protocol, keep an electronic copy. You will need a copy if it is necessary to make changes.

1 Protocol Title

Include the full protocol title: *Predicting homeowner wildfire mitigation behaviors in the Wildland-Urban Interface Main Study*

2 **Background and Objectives**

Provide the scientific or scholarly background for, rationale for, and significance of the research based on the existing literature and how will it add to existing knowledge.

- Describe the purpose of the study.
- Describe any relevant preliminary data or case studies.
- Describe any past studies that are in conjunction to this study.

Increasingly, wildfires are threatening communities, forcing evacuations, damaging property, and causing loss of life. This is in part due to a century of failed wildfire policy and an influx of people moving to the wildland urban interface (WUI). National programs have identified and promoted effective wildfire mitigation actions to reduce wildfire risk; however, many homeowners do not perform these actions.

This study seeks to identify the factors that influence and/or limit homeowners' wildfire mitigation behaviors. Based on previous literature and using the theory of planned behavior as a theoretical foundation, the study proposes an integrated wildfire mitigation model to assess homeowner mitigation behaviors.

The purpose of the study is to a) test the validity of the theory of planned behavior as a foundational model in exploring wildfire mitigation behaviors, b) develop and empirically test a wildfire mitigation model, and c) explore the role of homeowner associations (HOA) on wildfire mitigation behaviors.

Data gathered from the Prescott Neighborhood Firewise Study (STUDY00003153) and the Predicting homeowner wildfire mitigation behaviors in the Wildland-Urban Interface pilot study (STUDY00004151) were used in the development of study questions and aims. This current submission is for the main study which will be used to the theoretical models proposed.

3 Data Use

Describe how the data will be used.
Examples include:

- Dissertation, Thesis, Undergraduate honors project
- Publication/journal article, conferences/presentations
- Results released to agency or organization
- Results released to participants/parents
- Results released to employer or school
- Other (describe)

The data collected will be used in completing the requirements of a dissertation. Data will also be presented in oral and report form to the Prescott Area Wildland Urban Interface Commission, Yavapai County, the City of Prescott, National Fire Protection Association (NFPA) and United Service Automobile Association (USAA). Data collected will also be used in publications, journal articles, and conference presentations.

4 Inclusion and Exclusion Criteria

Describe the criteria that define who will be included or excluded in your final study sample. If you are conducting data analysis only describe what is included in the dataset you propose to use.
Indicate specifically whether you will target or exclude each of the following special populations:

- Minors (individuals who are under the age of 18)
- Adults who are unable to consent
- Pregnant women
- Prisoners
- Native Americans
- Undocumented individuals

The population being studied is owners, 18 years or older, of single family homes in and around the city of Prescott, Arizona that are located within the Wildland Urban Interface. To provide for later analysis of HOAs' impact on wildfire mitigation behaviors, the study will employ cluster sampling to account for equal representation of participants who own property in neighborhoods with and without an HOA. Participants in each cluster will be randomly selected based on these neighborhood level characteristics.

Due to the nature of focusing on home ownership, the study will inherently not include any minors or adults who are unable to consent. The study does not target any specific protected population such as pregnant woman, prisoners, Native Americans, or undocumented individuals. Though if a member of said groups owns a home in the study region, they could be part of the study representing the population.

5 Number of Participants

Indicate the total number of participants to be recruited and enrolled*:* 2,500

6 Recruitment Methods

- Describe who will be doing the recruitment of participants.
- Describe when, where, and how potential participants will be identified and recruited.
- Describe and attach materials that will be used to recruit participants (attach documents or recruitment script with the application).

The researchers of the study will be involved with recruiting. The study will develop the population lists through GIS and recruiting is through postal mail.

Sample development: The sample is specific to the Prescott area with unique neighborhood level characteristics needed. To gain the detailed level needed, researchers have worked with Yavapai County's GIS Department for access to parcel data layers. Through this and other data layers outlining the WUI, a population of homeowners within the study region within the Wildland Urban Interface was identified. Splitting the population into two groups of within a homeowners association and not in an association provides the two populations of study. Each population list will be randomly selected from for an initial sample of 1,250 from each.

Recruitment: Recruitment will be through the form of postal mailing using the standard Dillman's method. The first mailing will provide a cover letter, the questionnaire, a business reply envelope, a NFPA "firewise" sticker and brochure (donated by NFPA). The initial mailing will also have information on how to access the online-questionnaire with a unique participant code located on the back of the questionnaire (please see attached document "Questionnaire" and "Initial Cover Letter"). A reminder postcard will be sent a week later to those who have not completed the questionnaire (please see attached document "Reminder Postcard"). A final mailing will be sent two weeks after the reminder postcard is sent to those who have not completed the questionnaire. This final mailing will include the paper questionnaire, a cover letter, and a business reply envelope.

7 Procedures Involved

Describe all research procedures being performed, who will facilitate the procedures, and when they will be performed. Describe procedures including:

- The duration of time participants will spend in each research activity.
- The period or span of time for the collection of data, and any long term follow up.
- Surveys or questionnaires that will be administered (Attach all surveys, interview questions, scripts, data collection forms, and instructions for participants to the online application).
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- Previously collected data sets that that will be analyzed and identify the data source (Attach data use agreement(s) to the online application).

A questionnaire instrument will be used to collect participant responses. The study will implement an on-line and paper option for the questionnaire. Each participant will be provided a unique participant code to be entered into the on-line system. This code will also be placed on any paper questionnaires mailed to the participant. This code is to track who has responded and to identify any issues with repeat responses. The address and participant code database will be kept in a separate encrypted file from the participant response database to limit any ability to link the two. Both databases will be stored on a password protected computer. Participant responses will be kept confidential.

The questionnaire will take participants about 30 minutes to complete.

The main study will collect data from July 18th, 2016 through August 22nd, 2016.

Please see attached document "Questionnaire" for the questions that will be addressed in the study.

The study does not currently have any outside funding and costs incurred will be paid by the Co-PI's personal funds.

8 Compensation or Credit

- **Describe the amount and timing of any compensation or credit to participants.**
- **Identify the source of the funds to compensate participants**
- **Justify that the amount given to participants is reasonable.**
- **If participants are receiving course credit for participating in research, alternative assignments need to be put in place to avoid coercion.**

The study will not be providing any compensation or credit.

9 Risk to Participants

List the reasonably foreseeable risks, discomforts, or inconveniences related to participation in the research. Consider physical, psychological, social, legal, and economic risks.

The research team does not anticipate that the study participants will incur physical, psychological, social, legal, or economic harm during their participation in this study.

Participation in the study is absolutely voluntary and participants may decide to skip any of the questions or leave/withdraw from the study at any time.

10 Potential Benefits to Participants

Realistically describe the potential benefits that individual participants may experience from taking part in the research. Indicate if there is no direct benefit. Do **not** include benefits to society or others.

The participants will benefit from this study directly by identifying the dynamics involved with individual neighborhoods and the greater Prescott area. This better understanding will allow the neighborhoods to focus resources in those critical areas of need. In addition, the questionnaire will act as an informational tool to help inform homeowners of mitigation actions that can be taken to reduce their risk from wildfire as well as places to get more information.

11 Privacy and Confidentiality

Describe the steps that will be taken to protect subjects' privacy interests. "Privacy interest" refers to a person's desire to place limits on with whom they interact or to whom they provide personal information. Click here for additional guidance on ASU Data Storage Guidelines.

Describe the following measures to ensure the confidentiality of data:

- Who will have access to the data?
- Where and how data will be stored (e.g. ASU secure server, ASU cloud storage, filing cabinets, etc.)?
- How long the data will be stored?
- Describe the steps that will be taken to secure the data during storage, use, and transmission. (e.g., training, authorization of access, password protection, encryption, physical controls, certificates of confidentiality, and separation of identifiers and data, etc.).
- If applicable, how will audio or video recordings will be managed and secured. Add the duration of time these recordings will be kept.
- If applicable, how will the consent, assent, and/or parental permission forms be secured. These forms should separate from the rest of the study data. Add the duration of time these forms will be kept.
- If applicable, describe how data will be linked or tracked (e.g. masterlist, contact list, reproducible participant ID, randomized ID, etc.).

If your study has previously collected data sets, describe who will be responsible for data security and monitoring.

Only the PI and Co-investigator listed in this application will have access to the data.

Data will be stored on a password-protected computer to be maintained by one member of the research team.

Paper questionnaires and data results will be kept in a locked cabinet.

All electronic data will be kept in encrypted folders.

Participants will be given a unique participant code to track if they have responded.

Participant information connected to the participant code will be kept in a separate encrypted folder from the responses ensuring confidentiality.

Data will be stored for 5 years.

Data from the Prescott Neighborhood Firewise Study (STUDY00003153) and the Predicting homeowner wildfire mitigation behaviors in the Wildland-Urban Interface pilot study (STUDY00004151) is and will be maintained by the Co-PI as stated above and in previous IRB applications.

12 Consent Process

Describe the process and procedures process you will use to obtain consent. Include a description of:

- Who will be responsible for consenting participants?
- Where will the consent process take place?
- How will consent be obtained?
- If participants who do not speak English will be enrolled, describe the process to ensure that the oral and/or written information provided to those participants will be in that language. Indicate the language that will be used by those obtaining consent. Translated consent forms should be submitted after the English is approved.

Consent is obtained by the participant through their completion of the questionnaire. Described on the cover page of the questionnaire, participation in the Study is confidential and that its completion is voluntary. Please see attachment "Questionnaire" for the cover page.

13 Training

Provide the date(s) the members of the research team have completed the CITI training for human participants. This training must be taken within the last 4 years. Additional information can be found at: Training.

PI - Megha Budruk Ph.D. 8/11/2012
Co-PI Eric Steffey 10/11/2012

IRB EXEMPTION LETTER FOR MAIN STUDY

EXEMPTION GRANTED

Megha Budruk
Community Resources and Development, School of
602/496-0171
Megha.Budruk@asu.edu

Dear Megha Budruk:

On 7/20/2016 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Predicting homeowner wildfire mitigation behaviors in the wildland urban interface
Investigator:	Megha Budruk
IRB ID:	STUDY00004620
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Questionnaire, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Reminder Postcard, Category: Recruitment Materials; • Cover Letter, Category: Recruitment Materials; • Study Protocal, Category: IRB Protocol; • Consent page from questionnaire, Category: Consent Form; • Press Release, Category: Recruitment Materials;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 7/20/2016.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,
IRB Administrator

Eric Steffey Eric Steffey Megha Budruk

APPENDIX I

MAP OF STUDY POPULATION AREA

Map of Study Population Area