Research Perspectives on the Public and Fire Management: A Synthesis of Current Social Science on 8 Essential Questions

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Final Report to Joint Fire Science Program and Partners in Fire Education

Introduction

In August 2009, the executive team of Partners in Fire Education (PIFE) asked the Joint Fire Science Program for assistance in assessing how research could best inform their efforts to develop and implement a public education campaign to emphasize fire's natural role in ecosystems and the benefits of fire management to ecosystems and public health and safety (10-Year Comprehensive Strategy Implementation Plan, Goal 3,Task 2). Given that a significant base of potentially relevant research existed, a targeted synthesis of this material was recommended to first take advantage of existing scientific knowledge about public views and understanding of fire and management. PIFE therefore asked for a synthesis of current knowledge for the following questions:

1. What is the public's understanding of fire's role in the ecosystem?
2. Who are trusted sources of information about fire?
3. What are the public's views of fuel reduction methods, and how do those views vary depending on location in the wildland-urban interface (WUI) or elsewhere?
4. What is the public understanding of smoke effects on human health, and what shapes public tolerance for smoke?
5. What are homeowner views of their responsibilities for home and property protection and mitigation, e.g., defensible space measures?
6. What role does human health and safety play in public perceptions of fire and fire management?
7. What are public views on the role and importance of costs in wildfire incident response decisions?
8. How do findings differ among ethnic and cultural groups, and across regions of the country?

This document addresses these questions through a summary of common findings and patterns identified from existing fire research.

Methods

The process began by reviewing the questions of interest and making a list of relevant keywords that could be used in database searches, as well as a list of authors known to have contributed on each topic. Keywords included a wide range of words and phrases, including but not limited to: prescribed fire, smoke, suppression, health, ethnic, communication, mitigation, and knowledge. Database searches were then conducted to collect as much literature on the questions of interest as possible using keyword and author searches in the following databases: Agricola, Academic Search Premier, CAB Abstracts, GreenFILE, Treesearch (USFS), and Web of Science. Additionally, commonly cited journals were individually searched for relevant literature (e.g., Journal of Forestry, International Journal of Wildland Fire, Society and Natural Resources, Environmental Management, etc.). To best represent current public views and understanding, the search was limited to publications since 2000. The types of sources included journal articles, technical reports, proceedings, project reports, working papers, book chapters, and shorter science-brief type articles. While most sources were peer reviewed, a few were not (i.e., project reports, science briefs), and these are indicated with a * in the literature cited section.

The literature search was conducted by a team of social scientists. An initial search was conducted in spring 2010 with two additional searches conducted in May and July 2011 to ensure new articles were included. Periodic cross-checks were conducted on two sets of searches to ensure we were capturing as much relevant literature as possible. Finally, to further ensure adequate coverage, the reference lists for approximately 10% of the articles that most directly addressed the questions of interest were searched to ensure no articles had been missed. A database was then created in Excel to organize key points related to the PIFE questions of interest. Each of the eight questions was further divided into sub-topics. This spreadsheet was used as a guide to synthesize relevant findings for each question.

Findings

In the following "answers" to each question, we have attempted to identify key patterns in existing research and provide specific results from individual studies to demonstrate the range of findings. We found variable levels of research relevant to each question. The only question that was the focus of multiple studies was the question about public views of fuels reduction methods. For the remaining questions, relevant data tended to be found, at varying levels of detail, in studies primarily focused on assessing public response to fuels reduction or defensible space methods. Given the focus of most of this work on pre-fire mitigation issues, there were particularly few relevant research findings for questions regarding incident response. The limited number of studies with relevant findings for certain questions meant that identifying clear patterns was problematic. Therefore, when there was limited data specific to a question we looked at a broader interpretation of the question. It is also worth noting that results show that many of the topics are interlinked in the public's mind. As such, some of the best answers to one question may be found in multiple places throughout this document.

Most of the studies reviewed here involved members of the public who live or recreate near or in fire prone wildland urban interface (WUI) areas, often adjacent to a national forest. Many researchers target WUI residents because they are initially the most relevant audience for mitigation programs. Thus the "public" described here may not represent the general public. However, it is worth noting that those studies that used a national sample or sampled areas with little wildfire risk found substantially similar results to those that sampled individuals in high fire risk areas (see Differences discussion). Unless noted otherwise, when we refer to the "public" throughout this document, we are referring to residents and recreation visitors to the WUI.

Studies have been conducted throughout the United States, and a few international locations, using a variety of methods. Although both methods and research locations are on occasion referenced in the following discussion, specific methods and locations for each article are summarized in Appendix A (page 47). The main methods used in the studies are interviews, focus groups, and surveys. Each method has advantages in the type of information it can provide. Qualitative methods, such as focus groups and interviews, provide a more in-depth understanding of how people think about different fire issues, including the range of factors and interactions that shape decisions, and can provide a useful idea of the role of contextual factors. Surveys provide a clearer picture of the proportion of the sampled population that holds a certain belief or supports an activity and allow a greater ability to identify significant relationships and compare findings between study sites. For each question we worked to identify patterns in findings across both qualitative and quantitative studies. While the findings from non-probability samples used in most qualitative research are not generalizable to a broader population, identifying a pattern that holds across multiple studies using different methods provides a fairly robust identification of important social dynamics.

Knowledge

What is the public's understanding of fire's role in the ecosystem?

Public understanding of fire's role in the ecosystem is addressed in numerous qualitative studies as well as a number of quantitative studies. Overall the research paints a picture of a public that often has a sophisticated understanding of how fire fits in the ecosystem – both in terms of its ecological role and of environmental characteristics that contribute to increased fire risk. In qualitative studies, understanding of fire's role in the environment is referenced primarily in two ways: 1) awareness of the risks of living in a natural landscape and perceptions that the current forest is unhealthy from too many trees and/or a buildup of fuel (Brenkert-Smith 2011, Burns and Cheng 2007, Carroll et al. 2005, Cohn et al. 2008, Kent et al. 2003, McCaffrey 2008a, Paveglio et al. 2011, Weisshaupt et al. 2007) and 2) in discussions of overall forest management and the need to re-introduce fire, whether via prescribed fire or allowing some naturally ignited fires to burn (Knotek et al. 2008; McFarlane et al. 2007; Mendez et al. 2003, Winter and Cvetkovich 2007).

Many studies that involved interviews or focus groups found that participants' comments indicated a good or even a sophisticated understanding of the factors that contribute to fire risk, and of fire behavior and ecology (Brenkert-Smith 2011, Gordon et al. 2010, Flint 2006, McCaffrey 2008a, Monroe et al. 2006, Paveglio et al. 2011, Vining and Merrick 2008). For example, Monroe et al. (2006) found that the majority (84%) of respondents were aware of the risk and had a reasonable understanding of environmental conditions that influenced this risk including fire behavior and ecological conditions. Similarly, Paveglio et al. (2011) found that fire was seen as the main natural risk in the Spokane area and that participants had detailed knowledge about fire, including both its risks and its beneficial ecological role. In Minnesota, Vining and Merrick (2008) found that participants understood the complex nature and trade-offs of different fire management practices and understood "that fire-management techniques have just as many (or perhaps more) ecological benefits as negative ecological consequences." Even respondents in West Virginia, not generally seen as a high fire hazard state, were found to have a nuanced understanding of fire, including its consequences and occurrence given local vegetation, climate, and topography (Gordon et al. 2010).

A number of surveys have asked specific questions to measure knowledge levels and these provide additional evidence that the majority of individuals have a reasonable understanding of fire ecology. Respondents on Long Island showed overall awareness of local fire history and general forest characteristics (Ryan and Wamsley 2008). In four western states, Brunson and Shindler (2004) found respondents were reasonably knowledgeable about fire with at least 79 percent recognizing that some plants need fire to regenerate and at least half recognizing that fires do not typically kill most animals and that they can impact stream water quality. However, a larger proportion (49 – 77%) thought that fires kill most large trees, which was not an accurate reflection of the local fire regime, except in Utah. In another survey, participants exhibited similarly high knowledge levels: over 90 percent recognized that fire had played a

significant role in shaping forests in the western U.S. and over three quarters recognized that wildfire suppression had increased fire risk (Toman and Shindler 2006). In Arizona, Collins (2009) found that four-fifths of households answered all seven questions related to local fire ecology correctly. Finally, Jacobsen et al. (2001) found that at least two-thirds of respondents accurately answered five questions about fire in Florida including its role in forest renewal (79%) and in creating wildlife habitat (67%).

Education

Studies also suggest that even modest educational efforts can significantly raise both knowledge and support levels. Toman and Shindler (2006) found that for those with lower levels of knowledge and support for fire management, exposure to educational materials resulted in significant increases in both understanding and support. Similarly, participatory workshops in Idaho significantly increased both participants' fire knowledge and supportive attitudes toward fire management (Parkinson et al. 2003). In Florida, Loomis et al. (2001) uncovered lower initial agreement with use of periodic under-burning (64%), but discovered that after receipt of basic educational information this increased to 87 percent agreement.

Summary

Overall, studies provide ample evidence that members of the public recognize fire's ecological role. Indeed findings demonstrate that, particularly for those in high fire hazard areas, individuals often have a fairly sophisticated understanding of fire's ecological role. When knowledge levels are lower, a smaller number of studies suggest that provision of appropriate information can effectively increase knowledge levels and treatment support. This raises the question of how people learn about fire, a topic addressed in the next section.

Trusted Information Sources

Who are trusted sources of information about fire?

Answering this question is not as straightforward as it might appear because trust, whether it is attached to an individual or an organization, is dynamic and is highly dependent upon actions and relationships. Given this complexity, a full assessment of factors that influence trust is beyond the scope of this project; however, the topic is currently being assessed in another JFSP project (#10-3-01-25). We have therefore interpreted the question to mean which information sources do people tend to use to learn about fire management and which sources do they find most trustworthy and useful. As only one study (Taylor et al. 2007) focused on information needs during a fire, the focus of discussion is on pre-fire information.

Information Sources

At a general level, government is the preferred source of information on fire issues (Jarrett et al. 2009, McCaffrey 2011, McGee 2011, Monroe and Nelson 2004, Ostergren et al. 2006, Weisshaupt et al. 2007). This is reflected in perceptions that public education about fire risk and mitigation is in part a government responsibility (see Responsibility discussion). People also prefer information that takes local context into account and is from local sources (Kent et al. 2003, McCaffrey 2004, Ostergren et al. 2006, Parkinson et al. 2003, Taylor et al. 2007, Vogt et al. 2009). For instance, Vogt et al. (2009) found a preference for local information sources with the most positive response to materials from the local fire department or other local government agencies, and presentations to homeowners.

Findings show that there is no single best information source: individuals generally access multiple sources of information on fire risk and the use of sources varies by location. This variability is best demonstrated by the variability in specific study findings. In five southern states, state forestry agencies (38%) were the most frequently cited information source on wildfire prevention, followed by friends and family (25%) and state or county extension offices (24%) (Jarrett et al. 2009). In another study, McCaffrey et al. (2011) found that when respondents were asked about fire risk information sources, personal experience was most frequently mentioned followed by common sense, neighbors or a homeowners association, and agency outreach. But they also found that the use of each source varied across the five study sites (e.g., 26% used agency outreach in one site and 56% in another). Another example comes from the San Bernardino mountains where the top five preferred fire information sources were Forest Service public meetings (provided they allowed for dialogue), community meetings, web sites, brochures and articles in the local paper (Winter and Cvetkovich 2010).

Trusted Information Sources

Who are trusted sources of information about fire?

Source Trustworthiness

Which sources are seen as more credible or trustworthy varies by site, although government sources tend to rank highest. Shindler et al. (2009) found that the most trustworthy sources were often public agency sources, with over 75% finding all public agency sources, except public meetings, trustworthy. Most of the information sources Toman et al. (2006) studied were seen as trustworthy with over 90 percent finding all but three out of eleven sources trustworthy (internet web pages, conversations with agency employees, and government public meetings were the exceptions). The most trustworthy sources were Smokey Bear, interpretive centers, and guided field trips. Near Colorado Springs, residents were asked, based on their experience with the source, to rate different wildfire information sources: the National Park Service was seen as the most credible information source followed by the County/City fire departments, neighbors/friends, the Colorado State Forest Service, and the US Forest Service (Kent et al. 2003). The National Park Service's high credibility is notable given that while the Forest Service owns a substantial amount of land in the area, the closest National Park is over 100 miles away.

Although government sources are generally seen as trustworthy, government communication efforts are given more varied assessments. Paveglio et al. (2009) found that inadequate communication about fire risk from the Forest Service was frequently mentioned by Spokane focus group participants and likely related to a general lack of familiarity and trust in the agency as an organization. In Missouri, respondents only slightly agreed that the government did a good job of communicating about forest issues (Vogt et al. 2007). Shindler et al. (2011) found that the majority of respondents from the Great Basin provided low ratings for government outreach efforts A similar study in the Midwest found slightly more positive views; roughly equal proportions either agreed, disagreed, had a neutral opinion, or no opinion about whether the Forest Service was doing a good job of providing information about its management activities, being open to public input in management decisions, and building trust and cooperation with citizens (Shindler et al.2009). By contrast, Absher and Vaske (2011) found at least 82 percent agreeing that in relation to forest fire issues the Forest Service provided the best available information, enough information for the respondent to decide what actions they needed to take, truthful information about related safety issues, and timely information.

Usefulness

Usefulness of information sources is also quite variable. In Oregon and Washington, newspapers and magazines had the largest percentage indicate they were moderately to highly useful, followed by friends/relatives, timber groups, and the Forest Service, while environmental groups and the internet had the lowest ranking (Shindler and Toman

2003). This study reported findings from a follow up survey after four years and found that usefulness of only two information sources changed significantly: Forest Service as a useful information source decreased (from 60 to 47%) and timber groups increased (from 39 to 50%). In a Colorado study, the county and city fire departments were seen as the most helpful information source, followed (in order) by the Colorado State Forest Service, Firewise community information, media reports, and the US Forest Service (Kent et al. 2003). In three Midwest states, Shindler et al. (2009) asked about helpfulness of a variety of general (e.g., TV, family and friends) and public agency information sources (e.g., brochures, elementary school programs). In general, one-third of respondents found each information source very helpful and half found them slightly helpful. However, two sources, conversations with agency personnel and guided field trips, were clearly seen as more helpful, with at least half finding each very helpful and only 11 percent finding them not at all helpful. Two sources, environmental groups and the internet, were seen as less helpful with larger proportions finding them slightly (42-44%) or not at all (45-35%) helpful. In four western states, Toman et al. (2006) examined differences in helpfulness and trustworthiness of unidirectional (e.g., TV public service messages, brochures) versus interactive information sources (e.g., guided field trips, elementary school programs). The authors found, that as a group, interactive sources were significantly more helpful than unidirectional ones.

Interactive Information

As illustrated in the last two studies discussed, the stronger impact of interactive sources was perhaps the most consistent finding related to information preferences. A number of studies have found a preference for one-on-one interactions as well as indications that personal relationships with agency personnel can be important in making judgments about information and actions (Jarrett et al. 2009, McCaffrey 2004, McCaffrey et al. 2011, McFarlane et al. 2007, McGee 2011, Nelson et al. 2004, Parkinson et al. 2003, Paveglio et al. 2009, Toman et al. 2008, Winter and Cvetkovich 2010, Vogt et al. 2009). For instance, McCaffrey (2004) found that having government or personal contacts was associated with lower concern about prescribed fire issues including aesthetics, escape, and damage to trees; and that use of heavy equipment and herbicides were more acceptable practices. In another study, agency outreach was mentioned by one-third of all participants as a motivation to undertake defensible space actions, with a range of 15 to 63 percent across sites (McCaffrey et al. 2011). Shindler et al. (2011) found that positive ratings of citizen-agency interactions was significantly correlated with greater acceptance of prescribed fire for both urban and rural Great Basin residents . In Toman et al.'s study (2006), of the three highest rated trustworthy sources (Smokey Bear, interpretive centers, and guided field trips) the latter two more interactive sources also were

clearly the most helpful with roughly 20 percent more respondents indicating they were helpful. In an assessment of how field tours influenced perception of fuels treatments, participants indicated that the opportunity to discuss the treatments with an expert was as valuable as the ability to see the land after treatment (McCaffrey et al. 2008). Similarly, Toman et al. (2008) found that personal interaction with Forest Service staff was the most valued aspect of post-fire field tours and that after the tour over 60 percent of participants indicated they were more supportive of fuels treatments and had more confidence in the Forest Service's implementation abilities. Although homeowner desire for one-on-one interactions was predominantly focused toward government consultations, several studies have found that, for at least some homeowners, neighbors and community leaders can be influential information sources (Agarwal and Monroe 2006, Brenkert-Smith 2010, McCaffrey et al. 2011). In Colorado, one-on-one interactions with full-time residents was a key information source for part-time residents who saw their neighbors as the most knowledgeable individuals regarding mitigation options for their specific situation (Brenkert-Smith 2010)

Interactive communication also appears to be a factor in the quality of agency-community relationships. Studies have shown that increased agency-community interaction led to more positive feelings toward the agency (McGee 2011, Paveglio et al. 2009, Ryan and Hamin 2008). Conversely, Kumagai et al. (2004) found that after a fire those who either lived in a community that had little interaction with the state fire agency or did not receive up-to-date information during the fire were more critical of fire management.

Caveats

It is important to note that a high assessment of usefulness or trustworthiness does not necessarily translate into desired outcomes. For example, McCaffrey (2004) found that although television received relatively high awareness and usefulness ratings, information from this source was associated with a 15-20 percent lower likelihood of undertaking defensible space measures. Conversely neighborhood meetings (an interactive source) which had not been rated as a particularly useful information source were associated with greater likelihood of undertaking defensible space measures. Although Absher and Vaske (2011) found generally high levels of trust in Forest Service information they did not find a significant association between this trust and homeowners' reducing fuels and found a negative association with making changes to their structure. Further demonstrating the complexity of determining the impact of information sources, Bright et al. (2007b) found that although the three agencies the study specifically asked about were all seen as reasonably credible, the Colorado Forest Service was seen as significantly more credible than either the Forest Service or the local fire department and that both the credibility of the information source and the clarity of the

message were significantly related to how carefully people paid attention to fire information. However, the study also found that source credibility did not have an effect on how carefully people paid attention to firewise messages, though message clarity did. Only when a respondent paid careful attention was source credibility associated with increased likelihood of undertaking defensible space activities.

Other

Finally, although most studies focused on pre-fire communication, a few studies indicate that preferred information sources may vary over time. Monroe and Nelson (2004) found that for current fire information respondents preferred the news media, but trusted agency sources more for information about reducing risk before a fire. Taylor et al. (2007) found that during fires there was increased demand for up-to-date, site specific information from official sources, but also that there were different information needs at different points during an event, that information sources were different for evacuees (evacuation centers were a good source), and that mass media was seen as inaccurate and not sufficiently local.

Summary

Overall, the research highlights that the fire information sources people turn to and find helpful are highly varied. However, four general patterns can be identified. First, no single source is the best – it will vary by location and by type of information needed. Second, the most used information sources are not necessarily the most trustworthy and trustworthy information sources are not inherently useful. Third, government sources are generally a preferred information source and are often, but not always, highly rated. Finally, perhaps the most important characteristic in determining if an information source is trusted and useful is if it allows for interactive exchange. This is reflected in the preference study respondents had for one-on-one consultations and local information sources.

Fuels Reduction

What are the public's views of fuel reduction methods and how do these views vary depending on location in the WUI or elsewhere?

In assessing public views of fuels reduction methods, most studies focus on prescribed fire and some type of thinning, generally mechanized A few studies also examine grazing and use of herbicides or fuels reduction efforts after fires. Overall this body of work provides a picture of a public that generally supports the need for fuels reduction and helps identify some of the factors that influence support.

Prescribed Fire and Mechanized Thinning

Although more studies assess acceptance of prescribed fire, almost every study that asks questions about mechanical thinning or prescribed burning finds that over 80 percent of respondents accept some level of use of each practice (Absher and Vaske 2006, Brunson and Shindler 2004, Kaval 2007, Lim et al. 2009, McCaffrey 2006, McCaffrey 2008b, McCaffrey et al. 2008, Shindler and Toman 2003, Shindler et al. 2009, Shindler et al. 2011, Toman and Shindler 2006, Vogt et al. 2007, Walker et al. 2007). Several of the studies that found overall acceptance levels of over 80 percent used the same two statements to assess acceptance levels: "a legitimate tool that can be used anywhere" and "a tool that can be used infrequently in selected areas" (Brunson and Shindler 2004; Shindler and Toman 2003, Shindler et al. 2009, Shindler et al. 2011). Choosing the second, more qualified, statement to best represent one's view was considered to indicate acceptance given that agencies are selective in their use of both practices. For prescribed fire, respondents tended to be equally distributed between the unqualified and qualified acceptance responses (~40% each). For thinning, a greater proportion of respondents tended to choose unqualified acceptance rather than the more qualified acceptance response (50% vs. 30%). Although these studies cover at least 15 different sites in the West and Midwest, what is most notable is not the differences between sites but the commonality of findings across sites (see Differences discussion).

A few exceptions have been found to these high acceptance levels, although even the exceptions tend to find more support than opposition. For instance, two studies found high levels of support for prescribed fire (over 85%), but lower levels of support (57-68%) for mechanical thinning (Bowker et al. 2008, Monroe et al. 2006). Conversely, Toman et al. (2011) found high levels of support for thinning (83%) and lower levels of support for prescribed fire (66%). In the latter study, one of the five research sites did have lower levels of acceptance for both treatments, which the authors attributed to a sense that they were locally inappropriate given the community's steep landscape.

Fuels Reduction

What are the public's views of fuel reduction methods and how do these views vary depending on location in the WUI or elsewhere?

Preferences

Whether prescribed fire or mechanical thinning is the preferred practice varies: some sites show higher approval levels for thinning (Absher and Vaske 2006, Fried et al. 2006, Kent et al. 2003, Ryan and Wamsley 2008, Toman et al. 2011), others have relatively neutral preferences (Brunson and Shindler 2004, Walker et al. 2007), and others express higher approval rates for prescribed fire (Fried et al. 2006, McCaffrey et al. 2008). In several locations, participants preferred use of both practices together (Blanchard and Ryan 2007, Kent et al. 2003, McCaffrey et al. 2008, Vining and Merrick 2008).

The relative location of a treatment also appears to shape preferences. In general, studies have found a preference for use of mechanical thinning in more urbanized areas and for prescribed fire in less populated areas (Brunson and Shindler 2004, Knotek et al. 2008, McFarlane et al. 2007, Paveglio et al. 2011, Ryan et al. 2006). Similarly, the few studies that examine acceptability of letting naturally ignited fires burn found that acceptance was also dependent upon location, particularly in terms of risk to private property, with higher acceptance of fire use in more remote areas (Gunderson and Watson 2007, Kneeshaw et al. 2004b, McFarlane et al. 2007, Paveglio et al. 2011, Winter and Cvetkovich 2010). However, Toman et al. (2011) found an exception to this pattern with little difference between acceptance of use of prescribed fire in remote areas (66%) and around neighborhoods (62%) (although the latter did have higher proportions who judged it as unacceptable rather than neutral). In a California study, respondents also took land ownership into account in assessing treatment preferences, with prescribed fire the preferred practice for use on National Park Service lands and slightly stronger preferences for use of mechanical harvest (preferably in conjunction with prescribed fire) on Forest Service and private lands (McCaffrey et al. 2008).

No Action

When provided as an option, "no action" consistently is the least preferred choice (Bright and Newman 2006, Daniel 2006, Kent et al. 2003, McCaffrey et al. 2008, Olsen and Shindler 2010, Ryan and Wamsley 2008). In Massachusetts, Blanchard and Ryan (2007) found only moderate support for no action, although there was more support for active management, particularly prescribed fire, on public land than on private land. (This study also found significantly lower levels of support for prescribed burning on public land among those who leased cottages on the public land). Daniel (2006) found a preference for salvage and re-planting treatments over natural regeneration for sites disturbed by a blow down, with long-term future conditions having a larger impact on preferences than near-term future conditions. However, Olsen and Shindler (2010) found that while a large percentage were supportive of salvage logging after a fire, a majority also supported taking no action – a combination that the

authors concluded likely reflected recognition that across a large landscape certain treatments will be more appropriate than others for certain areas.

Grazing and Herbicides

There are fewer studies that consider public acceptance of alternative fuels management practices, including livestock grazing and use of herbicides. However, where studied grazing has been found to have a comparably high acceptance rate (~80%) to prescribed fire and mechanical thinning (Brunson and Shindler 2004, Shindler et al. 2011). In rural areas the largest proportion of respondents find the practice fully acceptable (generally over 60%) (Brunson and Shindler 2004, Shindler et al. 2011), while urban respondents are more likely to indicate qualified rather than full acceptance (McCaffrey 2008b, Shindler et al. 2011).

Much lower acceptance levels are found for use of herbicides, with the largest proportion of respondents finding their use unacceptable (Bowker et al. 2008, McCaffrey 2008b, Monroe et al. 2006, Toman et al. 2011). In Colorado, Kent et al. (2003) found chemical treatment preferred over prescribed fire in their initial interviews, but were less preferred in follow-up interviews conducted after the Hayman fire. Shindler et al. (2011) found that, along with chaining trees, use of herbicides had the lowest approval of offered treatments, although higher acceptance levels were found for rural respondents as compared to urban.

Considerations

Level of fire risk

Interestingly, few studies specifically addressed how level of risk influenced views of fuels treatments on public lands, rather most studies that examined this dynamic looked at the influence of risk perception on homeowner defensible space decisions. While a comprehensive assessment of defensible space studies is beyond the scope of this project, they suggest that while recognizing high risk is necessary it is not sufficient to engender proactive behaviors (McCaffrey 2008, McCaffrey et al. 2011). As in other hazard research, defensible space research has shown that multiple factors are at work. For example, Winter et al. (2009) found that high fire risk was one of three factors shaping acceptance of mandatory defensible space standards. The fact that few studies specifically discuss ties between level of risk and fuels treatments also is likely a byproduct of the fact that most were conducted in areas with high fire risk, in essence turning it into a constant. The high levels of understanding of fire risk and fire ecology found in studies (see Knowledge discussion) also suggests that high fire risk is assumed in most fuels treatments discussions.

Fuels Reduction

What are the public's views of fuel reduction methods and how do these views vary depending on location in the WUI or elsewhere?

The few studies that do explicitly discuss relationships between fuels treatment support and level of risk indicate that a high level of risk is an important component of support for fuels treatment. Most relevant is a study that examined how four contextual factors, including level of fire risk, influenced acceptance of three management actions (Bright and Newman 2006). The study found that for all three sites (Colorado, Southern Illinois, and Chicago) current conditions were far and away the most important factor for all treatments: higher fire hazard led to higher support for prescribed burning and mechanical thinning and lower support for no artificial treatments. Of the remaining three contextual factors location of treatment and wildfire history had some influence on support while primary use (outdoor recreation vs. commercial activities) had limited influence. A few other studies also found a significant relationship between level of perceived wildfire risk and treatment acceptance. Fischer (2011) found that private forest owners with higher levels of concern about a fire causing structure loss or affecting other aspects of their property were more likely to treat portions of their land. In another study, perception of high local fire risk was associated with higher acceptance of salvage logging, selective timber harvest, and hand thinning (McCaffrey 2008b). Finally on Long Island, Ryan and Wamsley (2008) found stronger support for fuel zones around forests from respondents in higher risk locations.

Forest Health

Forest health is generally a parallel, and sometimes more dominant, consideration than reducing fire risk in acceptability or approval of treatments (Bowker et al. 2008, Burns and Cheng 2007, Fischer 2011, McCaffrey et al. 2008, McFarlane et al. 2007, Paveglio et al. 2011, Vining and Merrick 2008, Walker et al. 2007). A national survey found the highest level of concern expressed by respondents was that "fire management programs consider long-term forest health" (64% concerned and 14% slightly concerned) (Bowker et al. 2008). McCaffrey et al. (2008) found that forest health and fire hazard were the two most important considerations in determining treatment preferences with 80 percent of respondents indicating that each was very important. In Oregon, forest owners who were more concerned about wildlife and ecological values were one and a half times more likely to have undertaken treatments on their land than those who were less concerned (Fischer 2011). In analyzing participant views of different fuels reduction scenarios Vining and Merrick (2008) found that ecological factors were the second most frequently mentioned topic (after safety) and that ecological benefits were mentioned more frequently than negative ecological outcomes. In a study focused on identifying the different ways that engaged citizens think about active forest management, Burns and Cheng (2007) found that consideration of forest health was the most common lens through which opinions of forest management were formed. For just under half of the

participants in the study, active management was viewed as necessary to improve ecosystem health and protect against large wildfire.

Potential Treatment Outcomes

Although not uniform across studies, risk of escape is generally the primary concern raised about prescribed fires (Blanchard and Ryan 2007, McCaffrey 2006, McFarlane et al. 2007, Monroe et al. 2006, Shindler et al. 2009), while erosion is usually the dominant concern with mechanical treatments (Blanchard and Ryan 2007, Shindler et al. 2009). Wildlife is often the next highest concern for both treatments, followed by aesthetics. Concern about smoke varies but is generally one of the lowest ranked concerns (see Smoke discussion) (Blanchard and Ryan 2007, Bowker et al. 2008, Jacobsen et al. 2001, Lim et al. 2009, McCaffrey et al. 2008, Ryan and Wamsley 2008, Shindler et al. 2009).

Potential treatment outcomes are not always seen as a reason not to use the practice. In fact, study participants often indicate that they expect the treatment to improve rather than detract from a particular value (e.g., restore natural conditions, improve habitat or scenery) (Blanchard and Ryan 2007, Brunson and Shindler 2004, Fischer 2011, McGee 2011, Toman et al. 2004, Vaske et al. 2007, Vining and Merrick 2008, Winter et al. 2006). The influence of outcomes on acceptance appears to be shaped by local context as studies generally find inconsistent associations between a specific outcome and support (or lack thereof) for a treatment, and when there are significant associations they vary across studies and across study sites. For example, Winter et al. (2006) found that only two of seven outcome variables were fairly consistently associated with acceptance across treatments sites: likelihood of escape was negatively associated with prescribed fire acceptance across all four sites and likelihood that a practice was cost-effective was positively associated with approval for all three practices for three of four sites. However, the remaining five outcomes were generally not significantly associated with acceptance and when significant relationships existed they varied by both site and practice.

Predictors

While certain potential treatment impacts, on occasion, are significantly associated with treatment approval, the two variables most commonly associated with fuels treatments acceptance are knowledge of a practice, and trust in managers to implement it.

Knowledge/Familiarity

Knowledge was the factor most commonly associated with treatment acceptance, with higher levels of knowledge or familiarity with a practice significantly associated with higher levels of acceptance for the practice (Absher and Vaske 2006, Blanchard and Ryan 2007, Brunson and Shindler 2004, McCaffrey 2004, Parkinson et al. 2003, Shindler and Toman 2003). Absher and Vaske (2006) found that a psychological index based on three variables—familiarity with the practice, views on aesthetics, and effectiveness—was a very strong predictor (explaining 39% of the variance) on approval of prescribed fire and thinning. The association between knowledge and acceptance also can be seen in the impact of field tours. For instance, in California, tours of fuels treatments had a positive effect on views of prescribed fire and a strong negative effect on views of untreated landscapes, but did not affect views of mechanical treatments (McCaffrey et al. 2008). In two separate Oregon studies, field tours were found to increase support for both thinning (Toman et al. 2008) and prescribed fire (Toman et al. 2004, Toman et al. 2008)

Higher knowledge levels are also associated with less concern about specific treatments, particularly for prescribed fire (see also Smoke discussion). In Massachusetts, some knowledge of prescribed fire was associated with less concern about aesthetics and having a great deal of knowledge was associated with lower concern about the effects on animals and their habitat. In addition, those with experience with wildfire had lower concern about several risks of prescribed fire (i.e., impacts of smoke, potential to escape, and damage to wildlife habitat) which the authors suggested was because those who had witnessed a wildfire developed a better understanding of how fires burn than those who had never seen a wildfire (Blanchard and Ryan 2007). In Long Island, the same study found respondents who were more familiar with prescribed fire were more willing to allow use of prescribed fire on private land, a location where use of prescribed fire is less likely to be seen as appropriate (Ryan and Wamsley 2008). In Nevada, McCaffrey (2004) found that those who had accessed prescribed burning educational materials were more likely to think it improved wildlife habitat and diversity, and less likely to agree that prescribed fire was unnecessary, that they did not like the appearance afterwards, or that smoke caused problems for a member of their household.

Trust

Studies have also found that public acceptance is influenced by perceptions of agencies and the individuals who are implementing the practice, specifically whether they are competent and trusted (Gunderson 2006, McCaffrey 2006, Monroe et al. 2006, Olsen and Shindler 2010, Toman et al. 2011). Several studies have found statistical relationships between trust in agencies to responsibly carry out a practice and treatment acceptance or approval, with higher

levels of trust associated with higher levels of acceptance (Fried et al. 2006, Shindler et al. 2011, Shindler and Toman 2003, Vaske et al. 2007, Winter et al. 2006). Toman et al. (2011) found significant correlations between acceptance and both agency trust and confidence (a form of trust) in an agency to implement a specific treatment. However, they found that only treatment specific confidence was significant in predicting acceptance, often in a very substantial way: one unit increase in confidence (from moderate to full) predicted an increase in acceptance of thinning by a factor of 6.2, of use prescribed fire in neighborhoods by a factor of 4.6, and of use of prescribed fire in remote areas by a factor of 2.7. Another study focused on Great Basin rangelands similarly found that, for both urban and rural respondents, the most highly correlated factor in acceptance of a treatment was confidence in a manager's ability to use a specific practice (Shindler et al. 2011).

Summary

Overall, results clearly show that prescribed fire and mechanical thinning are, at some level, acceptable management practices for over three-quarters majority of the public. While location and outcome concerns for a treatment are considered in determining acceptability, except for smoke (see Smoke discussion), these factors do not appear to be primary determinants of acceptance, but more contextual constraints. Instead levels of understanding of a practice, particularly its ecological benefits, and level of trust in those implementing a practice appear to be the primary variables shaping acceptance. These findings, combined with findings that: 1) no action is consistently the least preferred alternative, and 2) forest health is an equal or greater consideration as fire risk reduction, suggest that there is greater public support for active rather than passive land management in achieving ecological health and fire risk reduction goals.

Smoke

What is the public understanding of smoke effects on human health, and what shapes public tolerance for smoke?

Public response to smoke from wildfire and prescribed fire has been addressed only tangentially in social science research. Only one study, Weisshaupt et al. (2005), had a significant focus on smoke while in a number of others smoke was mentioned as just one of many considerations in how study participants thought about fuels management (Bell 2006, Carroll et al. 2004, McFarlane 2007). For the majority of studies smoke issues were examined through one to three specific questions, generally in relation to prescribed fire, amongst a larger set of questions about fire and fuels management (Blanchard and Ryan 2007, Bowker et al. 2008, Brunson and Evans 2005, Brunson and Shindler 2004, Jacoboson et al. 2001, Loomis et al. 2001, McCaffrey 2004, McCaffrey et al. 2008, Ryan and Wamsely 2008, Shindler and Toman 2003, Toman et al. 2004, Toman and Shindler 2006, Vogt et al. 2005).

The research suggests that while smoke is an issue, it is not a major concern for the majority of the public. Indications are that when smoke is an issue, it is primarily because of health reasons. A review of four studies found that approximately 30 percent of respondents had a household member with a health issue affected by smoke (McCaffrey 2006). Similarly, in several other studies 20-40% of respondents indicated relatively high levels of concern about prescribed fire smoke due to its potential health impacts (Ryan and Wamsley 2008, Brunson and Evans 2005, Jacobsen et al. 2001, Loomis et al. 2001, Shindler and Toman 2003). Other studies that only asked a general question about smoke from prescribed fire found a similar percentage of respondents who indicated smoke was a major consideration or concern (Bowker et al. 2008, Brunson and Shindler 2004, McCaffrey et al. 2008,). While this concern about smoke in general is not inherently due to health reasons, the consistency in percentages suggests that vulnerability to health impacts is a likely explanatory factor. These findings suggest that for roughly one-third of households smoke is a major issue, but that for others smoke is less important. This is reflected in the fact that a number of studies find that smoke and health issues are generally not seen as a reason to avoid using prescribed fire and that higher levels of concern are routinely expressed about other issues—including risk of escape, wildlife effects, erosion, aesthetics, human and property safety, and water supply (Bell 2006, Blanchard and Ryan 2007, Brunson and Evans 2005, Carroll et al. 2004, Jacobsen et al. 2001, McCaffrey et al. 2008, Toman and Shindler 2006).

Generally, more knowledge and/or experience with prescribed fire are associated with less concern about smoke (Blanchard and Ryan 2007, Loomis et al. 2001, McCaffrey 2004, Ryan and Wamsley 2008, Weisshaupt et al. 2005). In particular, recognition of the ecological benefits of prescribed fire appears to make smoke more acceptable to the majority of people (Shindler and Toman 2003, Weisshaupt et al. 2005). An interesting variant on ecological benefits was found in Weisshaupt's study (2005) which found that the source of smoke mattered: members of an anti-smoke group found smoke from agricultural burning unacceptable as benefits only accrued to the farmer, but as participants learned more about

the ecological benefits of a burn they became more willing to tolerate smoke from prescribed burns on public lands because the benefits accrued to multiple parties.

There also appears to be a general attitude among study participants that individuals who choose to live near natural areas need to live with smoke (Jacobsen et al. 2001, McCaffrey 2006, Weisshaupt 2005). Smoke from prescribed fires is also preferable to that from wildfires as it is seen as more manageable and allows for advance warning for those with health concerns (McCaffrey 2006, Weisshaupt et al. 2005). However, this association may not influence acceptance of prescribed fire use; Winter et al. (2006) found that while the majority of respondents agreed that prescribed fire would likely result in less smoke in the long-term, this belief was significantly associated with increased acceptance of prescribed fire in only one of four sites.

Brunson and Evans (2005) re-surveyed a population whose attitudes toward fire they had studied previously, which had been directly impacted by an escaped prescribed burn in Utah. Few significant changes were found after the escape except in relation to smoke where significant increases were found for concern about 1) increased smoke levels, 2) effects of smoke on public health, and 3) smoke management. Despite this, the authors found no significant change in the percentage (13%) that agreed that "because of smoke, prescribed fire isn't worth it." Another repeat study by Shindler and Toman (2003) found significant changes in concerns about smoke from 1996 to 2000 with fewer respondents agreeing that "smoke levels from fire are not a problem for me or my family" (from 76% to 61%) and that "smoke levels are acceptable if it results in a healthier forest" (from 68% to 58%). It is worth noting that, despite these changes, the majority still felt that given potential ecological benefits of fire, smoke was acceptable.

In a national survey, Bowker et al. (2008) found racial/ethnic differences with high levels of concern about smoke expressed by roughly twice as many African-American and Hispanic as Caucasian respondents. Gender was also significant in two studies, with women more concerned about smoke than men (Lim et al. 2009, Ryan and Wamsley 2008). Although multi-site studies found some variability in smoke responses between locations, the differences appear to have less to do with regionality than differences in local fire experience (See Differences discussion).

Finally, only two studies addressed public response to wildfire smoke. Kneeshaw et al. (2004b) found that individuals were less willing to accept less aggressive responses (such as let burn) when the actions contributed to poor air quality. Thapa et al. (2004) found that smoke concerns (health problems, automobile accidents, and general smoke) led some destination vacationers (5%) to cancel their trip and roughly 1/3 to change their destination.

Smoke

What is the public understanding of smoke effects on human health, and what shapes public tolerance for smoke?

Summary

Studies thus far suggest that smoke is not a significant barrier to the use of prescribed fire for a majority of the population and that a desire to improve forest health and/or reduce future fire risk tends to outweigh smoke concerns. However, findings also suggest that for roughly a third of households smoke is a major issue due to health concerns. This is a major portion of the population for whom smoke is, justifiably, a major concern. For these individuals, understanding how smoke issues are addressed in fire and fuels management will continue to be a highly salient issue.

Responsibility

What are homeowners' views of their responsibilities for home and property protection and mitigation (e.g., defensible space)?

A central difficulty with assessing findings relevant to this question is that within the fire management community, and in comments from the public, property protection and mitigation are often lumped together as one item. In some cases what is being referenced is active protection during a fire and in others "protection" includes notions of mitigation. This confusion is also reflected in research studies which address either mitigation on private property or general notions of "protection from wildfire," but which rarely distinguish between concepts of "protection" as different portions of the fire management cycles are being discussed.

Surveys highlight the difficulty of distinguishing between views of responsibility for mitigation and protection but begin to suggest that the public does not inherently interpret the phrase "protection from wildfire" to mean only protection during a fire. While surveys to date do not provide clarity about who is seen as responsible for what activity, the findings do suggest that the responsibility is seen as shared. For instance, in response to a question about whether private landowners or public agencies were responsible for protecting homes near a forest from wildfire, Absher et al. (2009) found that overall respondents did not agree with any of three distinct statements that homeowners, or the community fire department, or the relevant government forest agency were responsible for protecting homes from a wildfire. McCaffrey and Winter (2011) asked respondents in California, Montana, and Florida who (homeowners versus firefighters) was "most responsible for protecting private property from wildfire" and found that the majority of respondents put more (35%) or all (23%) of the responsibility on homeowners while a quarter indicated it was an equal responsibility. In a different approach, Winter and Cvetkovich (2010) asked respondents to divide up 100 responsibility points for reducing the fire risk in the San Bernardino mountains. The average points assigned were not markedly far apart with only seven points difference between the three highest entities, the Forest Service (which manages most of the land in the area), followed by Calfire (the state fire agency), and the respondents' household.

Qualitative studies further suggest that, particularly in terms of mitigation, responsibility is seen as shared. When discussing fire management, interview and focus group participants routinely bring up the notion of shared responsibility. In these discussions, each landowner, whether private or public, is seen as primarily responsible for taking care of their property (Brenkert-Smith et al. 2006, Cohn et al. 2008, Kent et al. 2003, McCaffrey et al. 2011, Paveglio et al. 2011, Vining and Merrick 2008, Vogt et al. 2009). The sense that homeowners see themselves as responsible for mitigating fire risk on their property is further supported by the fact that most studies on defensible space find that at least two-third of homeowners in areas with a significant fire risk are undertaking a variety of fuels treatments and other defensible space measures on their property, which demonstrates a sense of responsibility (e.g., Absher and Vaske 2006, Fischer 2011, McCaffrey 2008a, McCaffrey and Winter 2011, McGee 2011, Monroe and Nelson 2004, Shulte and Miller 2010, Winter and Cvetkovich 2010).

Responsibility

What are homeowners' views of their responsibilities for home and property protection and mitigation (e.g., defensible space)?

Adjacent Land

Informing the discussion of shared responsibility is recognition that the risk is shared: that as fire does not recognize property lines to be most effective fuels reduction measures often need to occur across ownership boundaries. A number of studies found that concern about actions on adjacent properties, whether the land was privately or publically owned, was an important consideration in whether individuals believed they could effectively create defensible space (Brenkert-Smith 2011, Fischer 2011, Kent et al. 2003, Martin et al. 2007, Paveglio et al. 2011, Shiralipour et al. 2006, Shulte and Miller 2010, Weisshaupt et al. 2007, Winter and Cvetkovich 2010). This concern may or may not lead to increased actions on one's own property. Fischer (2011) found that concern about conditions on nearby public land was associated with private forest owners being more likely to undertake fuels treatments on their land, while concern about conditions on nearby private property had no effect. Brenkert-Smith et al. (2006) found that homeowners felt that risk on their property was their responsibility but also were concerned about the threat from adjacent unmitigated private land and that, in response to this concern, neighbors had often worked together to reduce fuels across land ownerships. Concern about mitigation activities on adjacent lands was most frequently raised in relation to adjacent federal lands with a sense that the government was responsible for making sure "its practices do not negatively affect the surrounding citizens" (Weisshaupt et al. 2007). Concern about adjacent public land was also related to a sense of fairness; if the government asks residents to take care of their property, then it should be doing the same on its land (Winter et al. 2009).

In some cases, recognition of the shared fire risk across land ownership may create support for regulation. In New York and Massachusetts, Ryan et al. (2006) found little support for requiring homeowners to remove vegetation but several other studies found support for such requirements (Bowker et al. 2008, Vogt et al. 2009, Weisshaupt et al. 2007). Two-thirds of respondents to a national survey agreed that "where wildfire is common, homeowners should have to follow government guidelines to manage for wildfire risk." Levels of agreement were higher amongst Caucasians (73%) and lower amongst African Americans (54%) and Hispanics (57%) (Bowker et al. 2008) (see Differences section). In Vogt et al.'s study (2009) one of the three factors that made mandatory programs potentially justified was if individual noncompliance put others at risk. The other two factors were a recognized public safety role of local government and high fire risk: this last may explain the low support for regulation in Ryan et al.'s study where respondents did not see a high fire risk.

Responsibility

What are homeowners' views of their responsibilities for home and property protection and mitigation (e.g., defensible space)?

Choice

An argument underlying views of shared responsibility is the notion of choice – that if people choose to live in high fire risk areas they must also be willing to accept that risk and the associated responsibility, including financial obligations, for their own protection (Bowker et al. 2008, McCaffrey 2004, Paveglio et al. 2011, Weisshaupt et al. 2007). Two-thirds of respondents in a national survey agreed that those "who choose to live near forests or rangelands should be prepared to accept the risks of wildfire" Bowker et al. (2008).

Education and Fire Planning

Research has shown broad support for the idea that relevant government agencies have some responsibility for providing educational materials and advice to homeowners in reducing risk (Cohn et al. 2008, Jarrett et al. 2009, McCaffrey et al. 2011, Paveglio et al. 2009, Weisshaupt et al. 2007, Winter et al. 2009). Although responsibility for fire management planning is seen as primarily an agency responsibility, survey respondents expressed a clear desire that the public should to be kept informed about management activities and involved in the planning process at some level (Cohn et al. 2008, McFarlane et al. 2007, Paveglio et al. 2011, Ryan et al. 2006, Ryan and Hamin 2008, Toman et al. 2008). In Massachusetts, the most positive rating in the survey was that "public education and outreach should be part of a fire hazard reduction program" followed by support for resident involvement in planning focus groups and advisory committees. In Long Island the study found that 87 percent agreed "a lot" to "a great deal" that public education and outreach should be included in a fire hazard reduction program, while only 26 percent showed that level of agreement in relation to state and local officials having sole responsibility for developing fire hazard reduction programs (Ryan and Wamsley 2008).

Protection During a Fire

Only a few studies had findings specific to expectations of protection during a fire. Gordon et al. (2010) found that fire risk in West Virginia was seen as mostly a mining company responsibility, as the majority of fires were on corporate land. When a fire was not on mining land then respondents felt that the state was responsible for protecting forestland and the local fire department was responsible for taking care of homes. In Washington state, Paveglio et al. (2011) found that that participants saw primary agency responsibility as managing public land and not protecting nearby houses (Paveglio et al. 2011). Ryan et al. (2006) found that respondents in Massachusetts and especially Long Island had a strong belief that the local fire department would respond quickly to protect homes. In two Colorado communities,

expectations of protection differed based on whether the community had a fire department. The community that had a fire department focused on emergency response planning over mitigation, while the community without local protection focused more on mitigation, partly in recognition that firefighting resources were likely to be inadequate and also as a way to increase likelihood of firefighters choosing to protect their homes (Brenkert-Smith 2011). When asked what they would do if there were no firefighting services, many participants in Collin and Bolin's study (2009) indicated they would likely undertake different actions such as building a smaller house or undertaking more mitigation. Finally, McCaffrey and Winter (2011) surmised that respondents were not assuming firefighter protection given that when asked why they took mitigative actions on their property, although potential firefighter protection was a consideration, the main reason homeowners undertook took mitigation was the likelihood it would decrease the risk of home ignition and increase structural survival with or without protection.

Summary

Research shows a clear public view that responsibility for mitigating fire risk is shared by all landowners. Both a sense of fairness and recognition that actions on adjacent properties can affect one's fire risk shape this opinion. Beyond the view that the government is responsible for taking care of its property, there is also sentiment that the government has a responsibility to provide information on mitigating risk on private land. Finally, the confusion over how people think about the term "protection" – whether this is just a reference to active protection during an event or includes more passive protection from mitigation actions taken before a fire - is worth noting and suggests an area that future research may want to address more carefully.

Human Health and Safety

What role does human health and safety play in public perceptions of fire and fuel management?

No published study could be found that directly addresses the role of health and safety in public perceptions, though several studies did address it tangentially. Overall these studies begin to suggest that human health and safety issues underlie most assessments of fire management– from fuels management to fire fighting – but that they are more an implicit rather than an explicit consideration. At a general level, McFarlane (2007) found that public safety and protection was one of the three main topics raised when discussing the goal of fire management and that participants were open to letting some fires burn provided safety and infrastructure issues had been accounted for. Flint (2007) found that risk concerns fell into two distinct categories: immediate risks to property and safety, and more general risks to community and ecological well-being. In a survey of WUI residents in four western states, Brunson and Shindler (2004) found that slightly under half of respondents indicated great to moderate concern about human safety in relation to prescribed fire.

In terms of mitigation, an analysis of individual assessments of different fuels management scenarios found that safety was the most frequently raised topic, brought up by two-thirds of participants. Of note is that safety concerns, such as prescribed fire escapes, were mentioned only slightly more often than safety benefits of fire management, such as preventing large wildfires (Vining and Merrick 2008). Vogt et al. (2009) found that mandatory defensible space programs were seen as acceptable when three factors were present: high wildfire risk, individual noncompliance puts others at risk, and local government was seen to have a public safety role. The study also found that emphasizing the community health and safety benefits of defensible space practices was supported by homeowners. In many ways, health and safety concerns emerged most concretely in relation to use of prescribed fire, in terms of safety concerns related to escape and its use near structures (see Fuels Management discussion) and about smoke which is primarily a health issue (see Smoke discussion).

In relation to experiencing a fire, findings from a recent and not yet published survey of homeowners in four communities affected by wildfires in 2010 indicates that health and safety are key concerns during an event (Steelman and McCaffrey 2010). When asked how important certain considerations were in judging the fire management decisions made during the fire, firefighter and community/ resident safety were the two most important considerations in all four sites. Finally, a Utah study found that the top three concerns about potential fire impacts were related to public health and safety: deteriorated public water supply, damage to private property, and risk to human safety (Brunson and Evans 2005).

Human Health and Safety

What role does human health and safety play in public perceptions of fire and fuel management?

Summary

Although findings are too limited to provide a coherent picture, they suggest that members of the public put a priority on human health and safety and that, at a certain level, it underlies the entire fire management discussion. However, findings also indicate that there is recognition that protecting health and safety is not always straightforward and that sometimes current fire management practices that are a cause for safety concerns may also lead to future safety benefits.

Cost

What are public views about the role and importance of costs in wildfire incident response decisions?

Until recently, the focus of the majority of fire social science research has been on pre-fire mitigation efforts. Thus, it is not surprising there is little data specific to the question of public views of costs related to wildfire incident response decisions (i.e., firefighting). By necessity, the following section takes a slightly broader consideration of research findings and looks at public views of cost during any aspect of the fire management process.

As with health and safety, the most directly relevant information is from a recent and still to be published Joint Fire Science study (Steelman and McCaffrey 2010) that surveyed homeowners in four communities affected by wildfires in 2010. Homeowners in four fire affected communities were asked how important certain types of information were to receive during a fire and how important certain considerations were in their judgments about management decisions during the fire. In all four sites, firefighting cost was the least important information and consideration to respondents. The two most directly affected communities had lower average judgments about cost importance than the two less affected communities, suggesting that fire directly impacting an area results in less concern about cost.

The remainder of relevant findings focus on pre-fire costs and suggest that cost is a more important consideration before an event than during. In a national survey, a majority of respondents indicated they were concerned that taxpayer costs were "considered when developing fire management programs." The study found significant differences between different race/ethnicity groups with higher proportions of African Americans showing concern (73%) than Hispanics (44%) and Caucasians (31%) (Bowker et al. 2008). When respondents analyzed different fuels reductions scenarios, Vining and Merrick (2008) found that economic concerns were the fourth most frequently mentioned topic (by 35% of respondents), with the focus roughly equally split between concerns (e.g., costs of implementing the treatment) and economic benefits (e.g., reduced future firefighting costs).

Several other studies found that cost-effectiveness of an action, particularly its ability to reduce future wildfire costs, was an important consideration. McCaffrey et al. (2008) found that almost 80 percent of respondents indicated that concern about cost effectiveness was a somewhat to very important factor in determining their treatment preferences. In focus groups in Florida, Michigan, and California, cost considerations (e.g., costs of an escape, physical resources to do the job, etc.) were frequently brought up (Winter et al. 2002). In a follow-on survey, at least half of respondents at each site (the three original states plus Missouri) thought that mechanical harvesting (53-76%) and prescribed fire (50-80%) would save money by reducing cost of fighting a future wildfire, rating it a "very likely" or "certain" outcome (Winter et al. 2006). More importantly, the belief that saving money was a likely outcome of a fuels management method was positively associated with its acceptance in all sites except Missouri. This notion that it is better to pay now to reduce fuels than pay more later to fight fires was also

a consistent theme in ten focus groups held around Missoula and Spokane (Weisshaupt et al. 2007). In their survey of Colorado homeowners examining willingness to pay for prescribed fire, thinning, and fire suppression, Kaval and others (2006) also found support for reducing fuels now, and showed that those who had conducted defensible space activities were more willing to pay for thinning on public lands (Kaval and Loomis 2008).

Other studies where cost was raised addressed potential local economic impacts and defensible space costs. Concerns about economic impacts were fairly general and focused on impacts of experiencing an event. In a re-survey of Utah study respondents after a nearby escaped prescribed fire, concern about economic loss of usable timber increased from the pre-escape responses (from 32 to 51%) (Brunson and Evans 2005). Arvai et al. (2006) found significant differences in beliefs about the economic effects of a future fire between members of two Canadian communities, one that had recently been affected by a fire and one that had not. Residents of the unaffected community were more likely to believe that potential economic impacts would be negative and severe and that recovery would take longer. Conversely, Rasmussen et al.'s (2007) study found that tribal members tended to focus on the positive economic aspects of fire, frequently mentioning the economic opportunities of fire management including fuels management, firefighting, stewardship contracting and biomass removal. Finally, several studies have found that property owners cite economic costs as a key obstacle to adoption of fire mitigation activities, particularly for more expensive activities such as installing new roofs and increasing water supply (Absher et al. 2009, Collins and Bolin 2009, Martin et al. 2007, McFarlane et al. 2007, Winter et al. 2009). However, reflecting the previous discussion about cost-effectiveness, two studies also found that belief that creating defensible space was a cost-effective activity was associated with more positive views about defensible space (McCaffrey 2004, Winter et al. 2006).

Summary

Study findings are too few to draw clear conclusions about how cost factors into public assessments of fire management, let alone incident response. The one study with findings specific to incident response suggests that during an event, other considerations are more important than cost. However, studies suggest that before an event cost is a more important consideration, primarily in terms of the long-term cost-effectiveness of planned actions and the feasibility of defensible space activities.

Differences

To the extent that information is available, identify how findings differ among ethnic and cultural groups, and across regions of the country.

There is a common belief that people living in different regions of the country, or with different socio-demographic characteristics, or from different ethnic or cultural groups respond differently to fire management issues. However, analysis of social science research findings over the past 10 years indicates that geographic and socio-demographic differences are rarely key explanatory factors where fire management knowledge, attitudes, or actions are concerned. A more limited body of research, on the other hand, suggests that ethnic group membership and harder to measure differences such as culture and worldview may be more meaningful.

Geographic Differences

Quite a number of studies have explicitly included geographic variation as part of their design. Notably, the most consistent finding across these studies is that they detected much less variation than expected (Nelson et al. 2004, Shindler et al. 2009, Toman et al. 2006, Toman et al. 2011, Vining and Merrick 2008). Where geographic variation has been found it has either generally been too small to be meaningful or was seen to reflect specific local contextual factors, such as ecological conditions, regulations, building styles, agency-community interaction, or specific historical events (Bowker et al. 2008, Brunson and Shindler 2004, Kneeshaw et al. 2004a, McCaffrey et al. 2011, Mendez et al. 2003, Ryan 2010, Shindler et al. 2009). For example, one study found variation in responses across four states, but an examination of findings across papers (e.g. Winter et al. 2002, Winter et al. 2006) indicates that the variation is likely a reflection of local practices and experience: in California, where defensible space ordinances are very active, respondents were supportive of defensible space; Florida, where prescribed fire was most common, had the highest level of acceptance for prescribed fire; and Michigan respondents, who had experienced a damaging escaped prescribed fire, were most knowledgeable about fire damage and evacuation. Despite these differences, the authors found that the three strongest predictors of treatment acceptance (trust in the responsible agency, attitude toward treatment, and personal importance of a treatment) were consistent across regions of the country.

One common geographic variable thought to influence views is urban or rural residency. Evidence for this is limited because most studies have been conducted in WUI areas, but what there is suggests that assumption may not be that meaningful. A study by Shindler et al. (2011) provides an example of how urban/rural residency status seems important in some instances but not others: while they found a number of differences between urban and rural respondents' views of rangeland management in the Great Basin, differences were less distinct for wildfire-related issues. Although rural respondents tended to see primary threats to rangelands as due to ecological processes while urban residents were more likely to see the threats due to

human actions, roughly the same percentage (62-65%) of respondents from each group saw wildfire as a threat. In addition there were no significant differences between the two groups on acceptance of prescribed fire, although rural residents had higher acceptance levels for felling trees, livestock grazing, and using herbicides.

Other studies found few notable urban/rural differences. For example, Bright and Newman (2006) surveyed homeowners in the Front Range of Colorado (with recent fire experience), southern Illinois (low fire experience), and metropolitan Chicago (no wildfire experience). They found that differences between locations were few and minor, and primarily a matter of the degree of importance in second tier considerations (wildfire history and location of fire) in judging treatment acceptability. For all three options (mechanical harvest, prescribed fire, and no treatment), the current condition or risk level was the most important factor influencing acceptance in all three locations: if wildfire risk was high then both prescribed burning and mechanical treatment were more acceptable and no treatment less so. Brunson and Evans (2005) also purposively chose a sample of both urban and rural respondents in Wasatch County, Utah and found no significant difference in responses. Weisshaupt (2007) found that while Spokane, Missoula, and rural residents all tended to put primary responsibility for mitigating fire risk on homeowners, Spokane residents (the most urban of the sample) tended to put a bit more responsibility on government. Finally, McCaffrey (2008a) found the inverse of one common assumption related to urban rural differences: members of focus groups who lived in town (in areas unlikely to be directly affected by a fire) actually had higher assessments of the area's wildfire risk than those who lived in the interface or intermix. The author concluded that this inverse response reflected two dynamics: self-selection (risk averse individuals chose not to live in high fire risk areas) and a cost-benefit dynamic previously identified in risk perception research whereby the higher the perceived benefits of exposure to a potential hazard (e.g. living in the forest) the lower the perceived risk from the hazard. While these studies provide somewhat mixed evidence, they suggest that the urban versus rural distinction is not a consistently useful explanation for understanding differences in public response to wildfire. Indeed, the distinction appears to be more meaningful in shaping judgments of the appropriateness of different treatments in urbanized versus more rural areas (see Fuels Treatment discussion).

Socio-Demographic Differences

When discussing socio-demographic factors there are two general categories that studies address – standard demographic measures (age, income, education level, and gender) and residential characteristics such as length of residence and type of residents (permanent or seasonal). The most apparent dynamic for both of these measures is how often these

variables are found to be of no significance in relation to key variables, particularly support or approval of a treatment (Fischer 2011, Fried et al. 2006, Jarrett et al. 2001, Lim et al. 2009, Mendez et al. 2011, Shindler and Toman 2003, Toman et al. 2011). In addition, a number of surveys did not even report demographic findings, likely because they were either not significant or not meaningful. Furthermore, of the few studies that report significant relationships between fire-related attitudes and behavior, and education, income, age, or length of residence, relationships are not consistent between studies and no meaningful pattern can be identified. For example, of the eleven studies that specifically mentioned education as a variable, five found that it was not significantly associated with treatment approval or acceptance (Fried et al. 2006, Lim et al. 2009, Loomis et al. 2002, Shindler and Toman 2003,Toman et al. 2011). Two other studies found education significantly associated at some level with treatment approval: Absher and Vaske (2006) found a composite demographic variable was associated with prescribed burning and thinning; and Shindler et al. (2011) found that education was associated with prescribed fire acceptance for rural, but not urban, residents. Of the remaining studies, significant relationships with education were found for concern about certain treatment outcomes but not with approval (Lim et al. 2009), desire to be informed about restoration activities (Ostergren et al. 2006), attitude change after information provision (Toman and Shindler 2006), views on cutting trees and aesthetics (Weible et al. 2005), and trust levels (Winter and Cvetkovich 2007). One possible reason for this variation may be that, when significant, socio-demographic variables may simply reflect other more important dynamics within the study. For example, although McCaffrey et al. (2008) did find several significant demographic relationships, they also found that the variables were strongly correlated with group membership which the authors determined was a more consistently explanatory factor than the demographic variables.

The two socio-demographic variables where some pattern can be identified are gender and type of residency (permanent or part-time). However, in both cases it is important to note that the majority of studies either do not report on the variables or find no significant relationship with fire-related attitudes and behaviors. Gender differences have been found in relation to information and knowledge change (Toman and Shindler 2006), but are most commonly found in relation to risk response: studies have found that women have higher risk perception and concern levels and lower support for more controversial practices such as prescribed fire and herbicides (Jarrett et al. 2009, Lim et al. 2009, McCaffrey 2008a, McCaffrey 2008b, Ryan and Wamsley 2008, Shindler et al. 2009, Shindler et al. 2011). Worth noting is that Winter and Cvetkovich (2008) found a number of significant differences for gender, but also found that gender response differed by racial group. For instance, white females expressed more concern about fire than white males, while African American females expressed less concern than African American males.

Differences

To the extent that information is available, identify how findings differ among ethnic and cultural groups, and across regions of the country.

In terms of differences between part-time/ seasonal and full-time/ permanent residents, Toman et al. (2011) initially found that permanent residency was positively correlated with acceptance of prescribed fire and thinning but in subsequent regression analysis found no relationship. Vogt et al. (2003) found that the main significant differences between permanent and seasonal residents were in experiences with wildfire and that there was little difference between the two groups in approval of fuels treatments and defensible space. Fischer (2011) found that private forest owners whose primary residence was on the parcel were more likely to undertake fuels treatments on their land, and that distance of primary residence from the parcel was negatively associated with such actions. In relation to defensible space, Collins and Bolin (2009) found that part-time residents were less inclined to mitigate while full-time residents were more likely to take collective action in their neighborhoods. Similarly, Bright and Burtz (2006) found that full-time residents were more likely to undertake certain) defensible space activities and that social norms (i.e., influence of other people's opinions) were significantly related with permanent residents' landscaping activities. Seasonal residents in turn placed greater emphasis on lack of time as a barrier and perceived behavior control (i.e. ability to overcome barriers such as limited time) was significantly associated with their undertaking clearing activities. In another study, part-time residents routinely brought up time as a key barrier, but the authors found that interactions with full-time neighbors helped to engage part-time residents in mitigation actions and that a comparable or higher percentage of part-time residents had undertaken the simpler vegetative actions of limbing trees and clearing underbrush (Brenkert-Smith 2010). This last pair of findings suggest that time may be a key variable shaping seasonal residents actions and that neighborhood norms can also be an important factor, particularly for permanent residents.

Finally, a study by Absher and Vaske (2006) suggests why significant findings related to socio-demographic factors are so limited. While they did find that a composite variable of four demographic measures was significantly related to approval of prescribed fire and thinning and a second composite variable of residential factors was significantly related to likelihood of taking defensible space actions, each variable explained less than 7% of response variance. On the other hand, a psychological composite variable (familiarity, effectiveness, aesthetics) explained 27-44 percent of response variance for each activity indicating that these latter factors are much more important in determining approval.

Differences Between Groups

The few studies that have examined ethnicity or race have found a number of differences between groups (Bowker et al. 2008, Carroll et al. 2004, Jarret et al. 2009, Lim et al. 2009, Loomis et al. 2002, Winter and Cvetkovich 2008). In the Southeast, Jarret et al. (2009) found

that Caucasians were more likely than non-Caucasians to perceive the wildfire threat, have experienced wildfire, use wildfire program information, and construct fire lines. Caucasians also were less interested in workshops and government or technical assistance than other races studied. A national survey found a number of significant differences between three racial/ethnic groups: African Americans and Hispanics were less likely than Caucasians to support prescribed fire and were more concerned about smoke, harm to wildfire, and aesthetics (Lim et al. 2009). In a separate analysis on the same data, Bowker et al. (2008) found a number of significant differences between the three groups on acceptance of pre- and post-fire management actions and views of personal responsibility for mitigating risk. In four southwest states, Winter and Cvetkovich (2008) also found significant differences in concern about wildfire, wildfire knowledge, and agency trust between five different racial/ethnic groups: Native Americans, Hispanics, non_Hispanic whites, African Americans, and Asian Americans.

A number of studies suggest that the key factor shaping differences in views of fire management may be more intangible factors such as worldviews (Bright et al. 2007a, Burns and Cheng 2007, Liou et al. 2007, Mendez et al. 2003), group membership (Carroll et al. 2004, Collins and Bolin 2009, Findley et al. 2001, McCaffrey et al. 2008, Weible et al. 2005, Weisshaupt et al. 2007), or preferred use of public lands (Kwon et al. 2007, Ryan 2010, Shindler et al. 2011, Vogt et al. 2007). For example, McCaffrey et al. (2008) found that the primary explanatory factor for differences in level of acceptability of a treatment and treatment preferences was stakeholder group membership (e.g., entomologists, environmentalists, educational). In Arizona, amenity migrants were more likely than working class locals to discuss conflicting environmental values when considering defensible space (Collins and Bolin 2009). In a Colorado survey, Bright et al. (2007a) identified two distinct groups, individualist and non-individualist, based on responses to four belief dimensions: trust in land management agencies, freedom to build homes in the WUI, and government and homeowner responsibility to protect homes from forest fires. The individualist group had high levels of agreement for the importance of personal freedom and homeowner responsibility, slightly agreed that they trusted land management agencies, and disagreed that it was government responsibility to protect homes. The non-individualist group disagreed with the idea of personal freedom and had relatively high levels of trust in land management agencies, a neutral response on government responsibility, and agreed, although at a lower level, that homeowners were responsible for protecting homes from wildfire.

Differences

To the extent that information is available, identify how findings differ among ethnic and cultural groups, and across regions of the country.

Summary

While there is always a range of public response to different aspects of fire management, research suggests that, except for ethnicity and race, these differences are difficult to attribute to easily measurable or mappable variables, such as demographics and geography. Instead more complex, often identity based, and harder to measure factors, such as worldview and group membership, appear more likely to explain variation in how individuals respond to fire management issues.

Conclusions

Although the answers to some questions have more evidence than others, overall the findings provide a fairly clear indication that public response to a variety of fire management issues is more positive than is often assumed. Public response to fire is much more complex and sophisticated than the common truism "Smokey has taught the public to see all fire as bad" allows for. Indeed, the vast majority of the public, particularly in areas with high fire risk, have a fairly sophisticated understanding of fire ecology and behavior. Their concern for improving forest health and reducing the risk of wildfire underlies strong support for at least some level of prescribed burning and mechanized thinning. Support for active management is also shaped by recognition of the shared risk across land ownerships and an associated sense of shared responsibility whereby each land owner, whether public or private, is expected to mitigate the fire risk on their land.

No single factor leads to fuels treatment approval; rather, a variety of issues are taken into account in informal trade-off assessments that determine approval. Knowledge of a practice, particularly its ecological benefits, is associated with acceptance. However, as Brunson and Shindler (2004) noted, higher public acceptance cannot be developed simply by increasing knowledge, as other factors also come into play. Key amongst these is the level of trust in those implementing a practice. While there is limited evidence, concerns about health and safety and cost-effectiveness appear to be underlying considerations in judging appropriateness. Specific considerations about a practice can interact to influence individuals differently. For example, smoke appears to be particularly important for those households with respiratory issues and less important for the remainder of the population. Treatments may be supported because they are seen to improve rather than detract from an outcome that an individual values, such as improved wildlife habitat or aesthetics. Finally, although they would simplify prediction of likely response in a specific community or region, neither socio-demographic factors nor large-scale geographic differences appear to explain differences in beliefs or acceptance. Rather, differences in response appear to be due more to specific local contextual distinctions or more intangible elements such as worldview or stakeholder group membership.

However, how the public accesses information is a complex process where no single source is always more effective than another: different sources will be used in different geographic areas and by different individuals at different points in time. While government agencies are a preferred information source under most circumstances, individuals will turn to multiple sources and assess which one they think is most useful and trustworthy. The most consistent finding is that interactive information sources are both generally preferred and more effective. Such interactive communication with government sources also helps build trust and improves relationships.

Conclusions

Together these findings provide quite a bit of good news. Overall, the public has a reasonably sophisticated understanding of fire, is supportive of active management to reduce fire risk and improve forest health, and takes responsibility for mitigating the risk on their property. At the same time there is a bit of bad news – there is no single piece of information or best information source that shapes acceptance of active fire management or compliance with mitigation recommendations. However, taken together, this body of research suggest that interactivity is a key feature of information dissemination. The consistent, positive impact of interaction on trust and assessment of fire-related information argues for emphasizing interaction in outreach efforts at the local level. Interactive outreach would achieve multiple objectives by increasing the knowledge base and building agency-community trust, both of which will be critical to mitigating future fire risk and improved landscape health.

Finally, as was evident throughout this report, several topics cannot be answered definitively due to lack of research attention, suggesting areas where there is room for additional studies that could lend valuable information for fire management. In particular, there is a need for more work to understand social response during and after fires and whether and how that response differs and is influenced by response before a fire. For example, what distinctions, if any, do members of the public make in how they see protection responsibilities before versus during a fire? While a picture is developing of a public that is more knowledgeable and supportive of fire management endeavors than is often thought to be the case, better understanding such intricacies throughout the entire fire management cycle could help identify how to build on that support and design programs and policies that can cost-effectively restore fire adapted landscapes while reducing negative outcomes of future fires.

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Appendix A

Appendix A summarizes the specific methods and locations for each article reviewed in this report. Where multiple papers have been published from a single study, they have been listed in the table under the most commonly cited author of that study. When a specific study result is reported in multiple papers, we cite only one paper in the text to avoid inflating findings.

Study Citation	Study Site(s)	Method	General Topics	Questions
Absher et al. 2009,	Multiple	Summary of three studies	Defensible space, Information	Responsibility, Cost
Absher and Vaske 2011; Absher and Vaske 2006; Vaske 2007	Colorado (Front Range)	Survey	Defensible space, Information	Information, Fuels Reduction, Responsibility, Cost, Differences
Arvai et al. 2006	British Columbia	Workshop, Survey	Fire management	Cost
Bowker et al. 2008; Lim et al. 2009 (southern states)	National	Survey	Fire management module of Recreation and Environment Survey	Fuels Reduction, Smoke, Responsibility, Cost, Differences
Brenkert-Smith et al. 2006; Brenkert-Smith 2010; Brenkert-Smith 2011	Colorado (Front Range)	Interviews	Defensible space	Knowledge, Information, Responsibility, Differences
Bright & Burtz 2006	Minnesota	Survey	Defensible space	Differences
Bright and Newman 2006; Bright et al. 2007a (CO only)	Colorado (Front Range), Southern Illinois, Chicago	Survey	Fuels management, Defensible space	Information, Fuels Reduction, Differences
Bright et al. 2007b	Colorado (Front Range)	Survey	Information	Information
Brunson and Evans 2005	Utah	Survey	Fire management	Smoke, Health and Safety, Cost, Differences
Brunson and Shindler 2004; Toman et al. 2006	Arizona, Colorado, Oregon, Utah	Survey	Fuels management, Communication	Knowledge, Information, Fuels Reduction, Health and Safety, Differences

Appendix A - continued

Study Citation	Study Site(s)	Method	General Topics	Questions
Burns and Cheng 2007	Colorado	Interviews	Active management	Knowledge, Fuels Reduction, Differences
Carroll et al. 2004	Washington	Interviews	Fire management, Tribal views	Knowledge, Smoke, Differences
Cohn et al. 2008; Carroll et al. 2005 (AZ only)	Arizona, Colorado, Idaho, Montana, Utah	Interviews	Fire experience	Knowledge, Responsibility
Collins & Bolin 2009; Collins 2009	Arizona	Survey, Participant observation, Interviews	Defensible space	Knowledge, Cost, Differences
Daniel 2006	Minnesota	Survey	Forest management	Fuels Reduction
Fischer 2011	Oregon	Survey	Fuels management	Fuels Reduction, Responsibility, Differences
Flint 2006; Flint 2007	Alaska	Interviews, Survey	Beetle kill impacts	Knowledge, Health and Safety
Gordon et al. 2010	West Virginia	Interviews	Fire management	Knowledge, Responsibility,
Gunderson and Watson 2007; Gunderson 2006	Montana	Interviews	Fuels treatments, Place values	Fuels Reduction
Jacobsen et al. 2001	Florida	Telephone survey	Fire management, Defensible space	Knowledge, Smoke,
Jarrett et al. 2009	Alabama, Florida, Georgia, Mississippi, South Carolina	Survey	Fire management, Communication	Information, Differences
Kaval et al. 2006; Kaval 2007; Kaval and Loomis 2008	Colorado Front Range	Survey -WTP	Fuels treatments, Willingness to pay	Fuels Reduction, Cost,
Kent et al. 2003	Colorado, Hayman fire	Interviews, Focus groups	Fuels treatments, Defensible space, Communication	Knowledge, Information, Fuels Reduction, Responsibility
Kneeshaw et al. 2004a; Kneeshaw et al. 2004b	California, Colorado, Oregon	Survey	Fire management	Fuels Reduction, Smoke, Differences

Appendix A - continued

Study Citation	Study Site(s)	Method	General Topics	Questions
Knotek et al. 2008	Montana	Survey	Prescribed fire, wilderness visitors	Knowledge, Fuels Reduction
Liou et al. 2007; Kwon et al. 2007	Michigan	Survey (panel)	Fuels management	Differences
Kumagai et al. 2004 ;	California	Survey, Interviews	Post-fire	Information
Loomis, et al. 2001	Florida	Survey	Prescribed fire, Educational materials	Knowledge, Smoke
Martin et al. 2007	Colorado and Oregon	Survey	Defensible space	Responsibility, Cost
McCaffrey 2006	Multiple	Synthesis of multiple research reports.	Prescribed fire	Fuels Reduction, Smoke
McCaffrey 2008a	Arizona, California, Colorado, Montana, Nevada	Focus Groups	Defensible space, Risk perception	Knowledge, Responsibility, Differences
McCaffrey 2008b; McCaffrey 2004	Nevada	Survey	Fuels treatments, Defensible space, Communication	Information, Fuels Reduction, Smoke, Cost, Differences
McCaffrey et al. 2008	California	Survey (Post field tour)	Fuels treatments	Information, Fuels Reduction, Cost, Differences
McCaffrey and Winter 2011	California, Florida, Montana	Survey	Defensible space, Evacuation	Responsibility
McFarlane et al. 2007	Canada	Interviews	Fire management, Defensible space, Communication	Knowledge, Fuels Reduction, Smoke, Health and Safety
McGee 2011	Canada, Australia, United States	Interviews	Defensible space	Information, Fuels Reduction, Responsibility
Mendez et al.2003	Washington	Interviews	Fire management	Knowledge, Differences
Monroe and Nelson 2004; Monroe et al.2006; Nelson et al.2004;	Florida, Minnesota	Interviews, Survey	Fuels management, Defensible space	Knowledge, Information, Fuels Reduction, Responsibility, Differences

Appendix A - continued

Study Citation	Study Site(s)	Method	General Topics	Questions
Olsen and Shindler 2010	Oregon	Survey	Post-fire management practices	Fuels Reduction
Ostergren et al.2006	Arizona	Survey	Communication	Information
Paveglio et al.2009; Paveglio et al.2011	Washington	Focus Groups	Fire management, Communication	Knowledge, Information, Fuels Reduction, Responsibility
Parkinson et a. 2003	Idaho	Educational workshops	Education effectiveness	Knowledge
Rasmussen et al.2007	Oregon, Washington	Interviews	Fire management, Tribal views	Cost
Ryan et al. 2006; Ryan 2010; Blanchard and Ryan 2007 (MA only); Ryan and Wamsley 2008 (NY only)	Long Island, New York, Massachusetts	Survey	Fire management, Defensible space	Knowledge, Fuels Reduction, Smoke, Responsibility, Differences
Ryan and Hamin 2008	California, Colorado, New Mexico	Interviews, Focus groups	Post-fire recovery	Information
Shiralipour et al. 2006	Alaska, Colorado, Florida, New Jersey, South Dakota, Texas	Interviews	Defensible space, Neighborhood organizations	Responsibility
Shindler and Toman 2003	Oregon, Washington	Survey (longitudinal)	Fuels treatments	Information, Fuels Reduction, Smoke, Differences
Shindler et al. 2009	Michigan, Minnesota, Wisconsin	Survey	Fire management, Communication	Information, Fuels Reduction, Differences
Shindler et al. 2011	Idaho, Nevada, Oregon, Utah	Survey, Interviews	Fuels management	Information, Fuels Reduction, Differences
Schulte and Miller 2010	Colorado (Front Range)	Survey	Defensible space, Climate change	Responsibility
Steelman and McCaffrey 2010	Arizona, California, Colorado, New Mexico	Survey	During fire communication	Health and Safety, Cost

Appendix A - continued

Study Citation	Study Site(s)	Method	General Topics	Questions
Taylor et al. 2007	California	Participant observation, Interviews, Focus groups	During fire communication	Information
Thapa et al. 2004	Florida	Survey	Effect of fire on visitor plans	Smoke, Responsibility
Toman et al. 2004	Oregon	Survey (Pre and post site visit)	Effect of field tour on prescribed burning attitudes	Fuels Reduction
Toman et al.2008	Oregon	Survey	Post-field tour assessment	Information, Fuels Reduction,
Toman and Shindler 2006	California, Oregon	Survey (pre and post visit)	Fire management, communication	Knowledge, Fuels Reduction, Smoke
Toman et al. 2011 (OR and UT only); McCaffrey et al. 2011	Oregon, Utah, Idaho	Interviews, Survey	Defensible space, Fuels treatments, communication	Information, Fuels Reduction, Responsibility, Differences
Vining and Merrick 2008	Florida, Minnesota	Decision analysis survey	Fuels management	Knowledge, Fuels Reduction, Responsibility, Health and Safety, Cost
Vogt et al.2007	Missouri	Survey	Fuels treatments	Information, Fuels Reduction, Differences
Vogt et al.2009; Winter et al.2009	California, Colorado, Michigan, New Mexico	Focus groups, Survey	Defensible space	Information, Responsibility, Health and Safety, Cost,
Walker et al.2007	Colorado (Front Range)	Survey	Fuels treatments (WTP)	Fuels Reduction
Weible et al.2005	California	Survey	Thinning	Differences
Weisshaupt et al.2007	Washington, Montana	Focus groups	Fire Management	Knowledge, Smoke, Responsibility, Cost, Differences

Appendix A - continued

Study Citation	Study Site(s)	Method	General Topics	Questions
Winter et al.2002; Winter et al.2004; Winter et al.2006 (+ MO); Vogt et al. 2005; Vogt 2003; Fried et al.2006	California, Florida, Michigan,	Survey	Defensible space, Fuels treatments	Fuels Reduction, Smoke, Cost, Differences
Winter and Cvetkovich 2008	Arizona, California, Colorado, New Mexico	Survey	Fire management	Knowledge, Differences
Winter and Cvetkovich 2010	California	Focus groups, Survey	Defensible space, Fire management	Information, Fuels Reduction, Responsibility