



United States
Department of
Agriculture

Forest
Service

Northern
Research Station

General Technical
Report NRS-111

Social Science at the Wildland-Urban Interface: a Compendium of Research Results to Create Fire-Adapted Communities

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Abstract

Over the past decade, a growing body of research has been conducted on the human dimensions of wildland fire. Building on a relatively small number of foundational studies, this research now addresses a wide range of topics including mitigation activities on private lands, fuels reduction treatments on public land, community impacts and resident behaviors during fire, acceptance of approaches to postfire restoration and recovery, and fire management policy and decisionmaking. As this research has matured, there has been a recognition of the need to examine the full body of resulting literature to synthesize disparate findings and identify lessons learned across studies. These lessons can then be applied to fostering fire-adapted communities—those communities that understand their risk and have taken action to mitigate their vulnerability and increase resilience.

This compendium of social science research findings related to fire-adapted communities has resulted from a project funded by the Joint Fire Science Program (JFSP). As part of these efforts, the research team reviewed more than 200 publications of research results. Then the team convened a workshop with 16 scientists with extensive experience in the human dimensions of fire management issues. Workshop participants evaluated collective findings and discussed their application to support fire management activities. In addition to this compendium, project outputs were: 1) a synthesis of published literature specific to eight management questions identified by the JFSP, 2) a list of future research needs, 3) a bibliography, including abstracts, with accompanying subject area guide, and 4) a video featuring the experiences of agency personnel and community leaders in successful collaborative fire planning settings. This video is accompanied by a field guide for use by agency managers to more effectively participate in building fire-safe communities.



In the sections that follow, we describe our approach to completing this review and present key findings from the literature. Our discussion is organized around five major topical areas: 1) homeowner/community mitigation, 2) public acceptance of fuels treatments on public lands, 3) homeowner actions during a fire, 4) postfire response and recovery, and 5) wildland fire policy and planning. The compendium concludes with a presentation of management implications and a bibliography of all material in this review.

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Cover Photos

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Manuscript received for publication July 2012

Published by:
USDA FOREST SERVICE
11 CAMPUS BLVD., SUITE 200
NEWTOWN SQUARE, PA 19073-3294

For additional copies:
USDA Forest Service
Publications Distribution
359 Main Road
Delaware, OH 43015-8640
Fax: 740-368-0152

March 2013

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I. INTRODUCTION

The management of wildland fires has been a central part of the missions of federal land management agencies in the United States since these organizations' earliest days. As with other aspects of natural resource management, the approach to managing wildland fires has evolved over time as scientific understanding has advanced and the broader context surrounding management decisions has changed. The most significant change in fire policy has been the shift away from strict suppression of all wildland fires to a more flexible set of management strategies. These strategies include proactive vegetation removal to reduce potential fuels and allowing some naturally ignited fires to burn while being monitored, in addition to fire suppression when deemed necessary.

Much has been written about the fire management problem and its evolution. This report seeks to build on this existing body of knowledge to provide a review of key findings from the social science literature related to fire-adapted communities on the following topics: homeowner mitigation activities, wildland fire and fuels management, community response to wildfire, postfire recovery, and wildfire policy and planning. Our intent is to organize this information to support local efforts by fire managers and other interested stakeholders to foster fire-adapted communities, and to provide a context for future research. Creating fire-adapted communities, where there is an awareness of the risk of fire and actions have been taken to mitigate that risk and increase resilience, is both an individual and a collective effort. It requires participation by residents and community leaders, and often the cooperation and assistance of public land management agencies.

Historical Perspective

Social scientists have conducted research on the human dimensions of wildland fire management for more than 40 years. However, as illustrated in Figure 1, the vast majority of this work has been conducted within the last decade. The earliest inquiries into public attitudes toward fire management were completed as the U.S. Forest Service (USFS) considered modifying its policy to allow some naturally ignited fires to burn in Wilderness areas under previously specified conditions (e.g., location, wind speed, humidity) (U.S. Forest Service 1978). The first prescribed natural fire (as the management practice was then known) was allowed to burn in Montana's Selway-Bitterroot Wilderness in 1972. In a 1971 survey of users of the Selway-Bitterroot Wilderness area, Stankey (1976) found that visitors generally overestimated the negative impacts of fire while underestimating fire's beneficial effects. Not surprisingly, a majority of survey respondents preferred complete fire suppression.

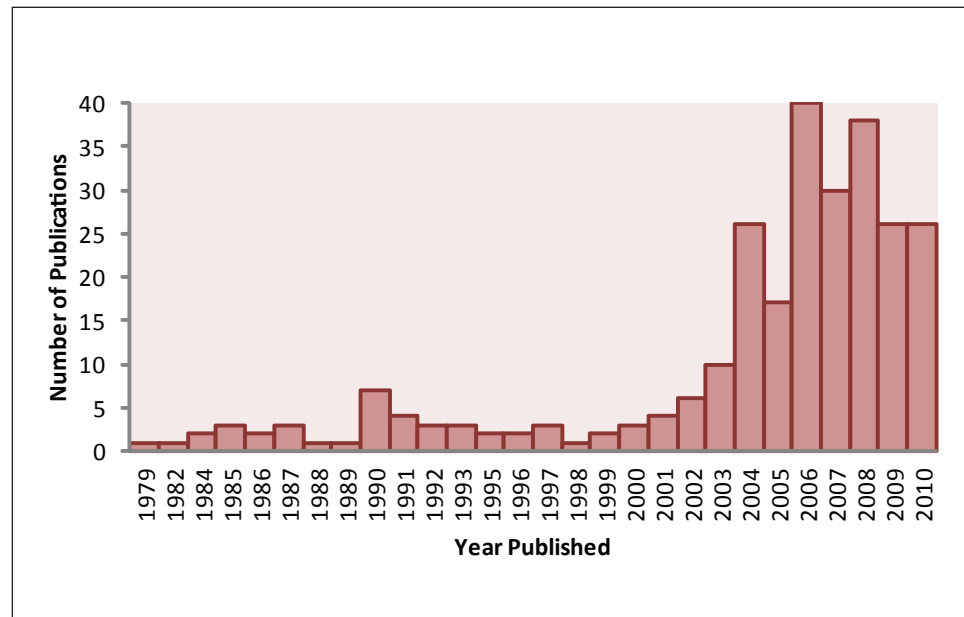


Figure 1.—Publications of wildfire social science.

In subsequent years, additional studies expanded the research focus beyond recreation users to the general public. A series of studies completed by Cortner, Taylor, and colleagues (e.g., Carpenter et al. 1986, Cortner et al. 1984, Gardner et al. 1985, Taylor and Daniel 1984, Taylor and Mutch 1986) found research participants had increasing levels of both understanding of treatment outcomes and acceptance of management-ignited prescribed burns. These results were confirmed by McCool and Stankey (1986), who used a trend analysis with current users of the Selway-Bitterroot Wilderness area when replicating Stankey's (1976) research.

Another increase in social science research occurred following the Yellowstone fires in 1988. These fires captured national attention and emphasized the complex natural and social components of fire management. It was during these fires that citizens from across the country first learned of the practice of prescribed natural fires, then generally described as a "let burn" policy. Media coverage and initial public reactions were quite negative and the fires were viewed as ecologically destructive. Moreover, agency managers' competency was questioned and their decisions were second-guessed (Lichtman 1998). A review following the fires supported the essential elements of the let burn policy, but also concluded that despite the ecological benefits, the resulting social impacts may be too great to allow some fires to burn in some instances (Wakimoto 1989). Immediately after these fires, Manfredo et al. (1990) compared awareness and attitudes toward fire management between a national sample and one from the Yellowstone region.

They found citizens in the Yellowstone region exhibited greater understanding of wildfire and support for alternative fire management policies than the national sample. Around the same time, other scientists began to examine the importance of the wildland-urban interface (WUI) to the success of fire management programs (Cortner et al. 1990, Phillips and George 1991).

Throughout the 1990s study findings continued to build the knowledge base of fire social science at a steady, but fairly low, rate of publication. With the advent of the Joint Fire Science Program in 1998, fire research became funded more consistently. Subsequently, the 2000 fire season led to creation of the National Fire Plan, which provided additional funding for fire research, including more support for social science research. In the following years, a substantial body of social science research has emerged, supported by the Joint Fire Science Program and the National Fire Plan.

As the 10-year mark of the establishment of the Joint Fire Science Program approached, the research team proposed to take stock of the key lessons provided by the social science literature. Project efforts entailed conducting a review of the fire social science literature, hosting a workshop attended by scientists actively engaged in fire social science research, producing a synthesis of published literature specific to eight management questions identified by the Joint Fire Science Program (McCaffrey and Olsen 2012), identifying future research needs (McCaffrey et al. 2012), compiling a bibliography with abstracts¹, and developing a digital video production with an accompanying field guide to highlight successful fire management programs and provide guidance on developing collaborative approaches to maintaining healthy forests². This compendium presents findings from our review of the fire science literature.

Today's wildland fire management is increasingly challenging. With a growing number of acres burned annually and an increasing population in the WUI, much is at stake. This compendium is designed to help inform efforts of fire managers and communities to effectively reduce communities' exposure to fire hazards.

¹ Social Science at the Wildland-Urban Interface: 2000-2010 Annotated Bibliography, available at: <http://hdl.handle.net/1957/34537>

² Collaborating for Healthy Forests and Communities: A Guide for Building Partnerships Among Diverse Interests, available at: <http://hdl.handle.net/1957/29896>

II. APPROACH

The research team conducted an extensive review of the available social science literature on wildland fires. The following procedures were used to organize this review (based on Littell et al. 2008).

1. **Topic formulation:** The goals of this compendium are to examine and organize the collective social science research conducted at the WUI, evaluate key factors that influence public support and homeowner behavior, and identify lessons for fire managers.
2. **Review design:** The research team established the following criteria for inclusion in the review. To be included, papers and reports:
 - a. Addressed one or more issues related to fire management using an established social science approach. Economic studies were excluded from the review due to fundamental differences in approaches and resulting data.
 - b. Were published in peer-reviewed or editor-reviewed literature (including USFS General Technical Reports and conference proceedings).
 - c. Were published or in “in press” status (indicated by †) between January 1, 2000 and December 31, 2010.
3. **Sampling:** Based on these criteria, literature searches were then conducted in several online databases (e.g., Web of Science, Treesearch, Google Scholar) using pre-identified keywords (e.g., wildfire, social, public, perception, mitigation, community, thinning, prescribed burn, evacuation, communication). Searches were also performed on the most prominent social scientists active in studying fire management issues and in the journals that most often publish fire social science literature. The resulting database of articles was provided to an external group of scientists who reviewed it for completeness. Additional articles suggested for inclusion were reviewed for consistency with the above criteria. Through these efforts, the research team completed a review of more than 200 publications of research results written by well over 100 individuals. All of the articles in this review, including those that are not directly cited in this document, are presented in Section VI of this report.
4. **Analysis and interpretation:** Using an approach similar to grounded theory (a systematic methodology that applies a set of procedures to identify conceptual categories and their interrelationships—see Glaser and Strauss 1967), the research team reviewed each article and categorized key findings. Findings from individual articles were then organized into overarching themes. Preliminary results from this analysis were provided to an external

group of scientists for further review and discussion in a workshop held in Portland, OR, in August 2008. Sixteen of the primary social scientists (see Appendix I) working on fire management issues attended the 2-day workshop. Attendees reviewed findings, considered their relevance to managers, and discussed future research needs. Following this workshop, the research team used the initial review and workshop discussion to further refine the themes and guide more in-depth analysis.

III. FINDINGS/DISCUSSION

Our analysis of the research findings identified the following five main themes of work within the fire social science literature: 1) community/homeowner mitigation, 2) public acceptance of fuels treatments on public lands, 3) homeowner behaviors during fire and perceptions of fire management practices, 4) postfire response and recovery, and 5) wildland fire policy and planning. The number of articles included in each theme is described in Table 1. Our discussion of findings is organized around these themes in the subsequent sections.

A consideration in interpreting findings is that, within the scope of this project, the majority of wildfire social science research has taken place in the United States, predominantly in the western half of the country (Fig. 2). International research was completed in Canada, Australia, New Zealand, and Greece. Although the higher proportion of sites in the western United States could suggest that results are less applicable to other areas of the country, we did not see a strong indication that key social dynamics differ substantially across regions. A related consideration is that with a few exceptions (Bowker et al. 2008, Bright and Newman 2006, Winter and Cvetkovich 2008a), most of the research participants in the studies reported here live in or own homes in the WUI and thus may be more aware of wildland fire than perhaps the general public. Again, findings across studies suggest such geographic distinctions may not be that meaningful in understanding differences in response to wildfire. In fact, social science studies that included multiple study sites often found that there were more similarities than differences between sites.

Table 1.—Research themes and corresponding article counts included in the compendium.

Theme	Article count
Homeowner/community mitigation before fire	84
Public acceptance of fuels treatments on public lands	83
Homeowner behaviors during fire and perceptions of fire management practices	41
Postfire response and recovery	32
Wildland fire policy and planning	69
Total articles in review	242 ^a

^a Some articles are included in more than one theme.

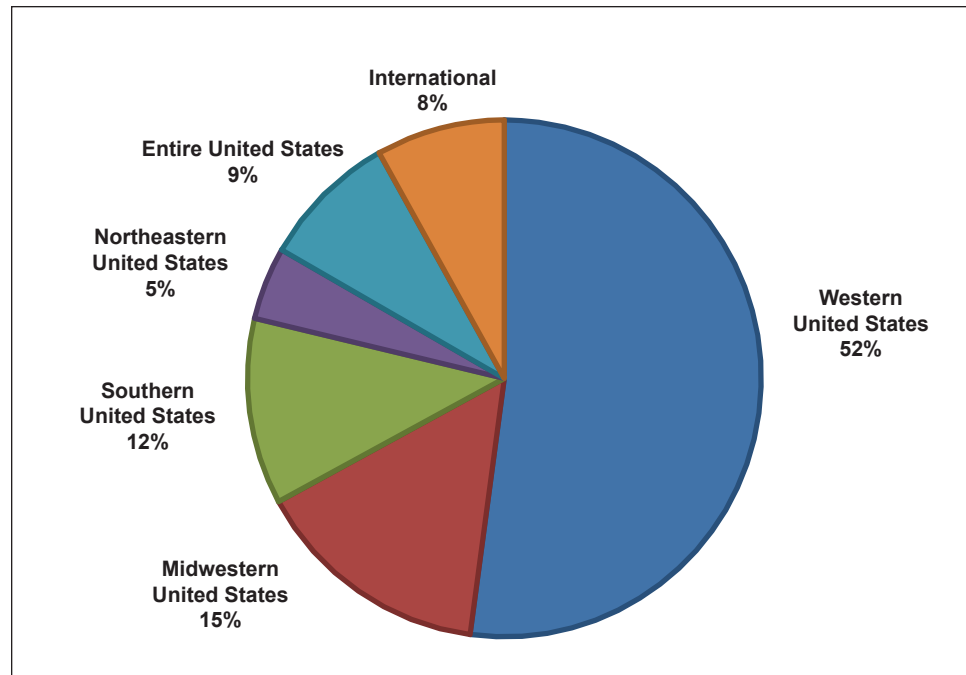


Figure 2.—Locations of wildfire social science studies.

When differences were found, they were generally attributed to specific local contextual elements such as history of fire management and fuel treatments, existing relationships between agencies and local communities, building style, or ecological conditions (for a more specific discussion on the subject see a related project document, McCaffrey and Olsen 2012). This is not to discount such differences when they do occur, as they can be highly influential and emphasize the need for managers to understand their local communities and tailor programs to their needs.

THEME 1 – HOMEOWNER/COMMUNITY MITIGATION

This section synthesizes 84 studies that examine actions taken by individual property owners and communities to reduce the threat of fire impacts. Topic areas in this section are as follows:

- Adoption of risk reduction behaviors
- Factors influencing adoption
- Barriers to adoption
- Responsibility for mitigation on private property



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Key Lessons from Theme 1:

1. Many residents in the WUI are taking action to reduce their fire risks.
2. Awareness of risk does not automatically lead to adoption of risk reduction behaviors.
3. Decisions to mitigate the risk of fire are shaped by a variety of factors, including perceived effectiveness, ability to implement, and trade-offs with other values.
4. Most residents in the WUI feel that mitigating fire risk on their property is their responsibility.

Adoption of Risk Reduction Behaviors

Residents in fire-prone communities are generally aware of their fire risk and most report taking some action to reduce that risk (Absher and Vaske 2006, Brenkert-Smith 2006, Cvetkovich and Winter 2008, Jarrett et al. 2009, Kent et al. 2003, Kyle et al. 2010, McCaffrey 2008b, Nelson et al. 2005, Ryan 2010). These findings are consistent across locations (studies in the South, Northeast, Lake States, Rocky Mountains, Southern California, and the Pacific Northwest), across research teams, and when using different research methodologies (ranging from qualitative interviews to structured surveys and quantitative decision models).

Adopted activities include a range of behaviors to mitigate the risk of fire, such as modifying vegetation, reducing flammability of structures, improving access and visibility of the home for fire suppression personnel, and developing an evacuation plan. Adopted behaviors reflect actions recommended through FireWise and other organizations noted in Table 2. However, not all activities are uniformly adopted—not surprisingly, activities with a lower initial cost (in terms of expense or time and effort required) are more likely to be adopted (Brenkert-Smith et al. 2006, Bright and Burtz 2006a, Schulte and Miller 2010). For many residents, activities such as raking needles, mowing vegetation adjacent to their homes, and clearing needles and leaves from their roofs appeared to be part of their normal chores to keep their homes and properties neat and orderly (Bright and Burtz 2006a).

Table 2.—Examples of common actions taken by homeowners to reduce their fire risk.

Access	Structure	Vegetation
Improving visibility of home address	Installing a fire-resistant roof	Removing dead vegetation and debris
Widening driveway for emergency vehicles	Using fire-resistant building materials	Maintaining low vegetation near home
	Cleaning roofs and gutters	Maintaining irrigated green area
	Stacking wood 30 feet from house	Planting fire-resistant shrubs
	Installing additional water supply	Spacing plants 15 feet apart
	Installing screens under decks and over vents	Pruning lower branches of trees within 30 feet of home
		Reducing density of trees within 100 feet of home
		Removing branches within 10 feet of roof

While adoption rates are high, nearly all of the research on mitigation activities has focused on whether actions were taken, but not on whether they are being maintained over time. To date, limited research addresses this important point. While not conclusive, some studies provide positive information that property owners see their risk reduction behaviors as a multi-year process and discuss ideas about additional activities they will complete in the future (Brenkert-Smith et al. 2006, Nelson et al. 2005).

Factors Influencing Adoption of Risk Reduction Behaviors

An often-repeated assumption is that homeowners fail to adopt risk reduction behaviors because they do not understand their fire risk. Following this assumption, the logical next step would be to develop educational materials to build awareness of the fire risks associated with living in the WUI. However, studies in several areas suggest that residents generally understand that living in the WUI brings with it increased risks of fire (Brenkert-Smith et al. 2006, Cohn et al. 2008, Cvetkovich and Winter 2008, Gordon et al. 2010b, Jarrett et al. 2009, Kent et al. 2003, Martin et al. 2009, McCaffrey 2008b, Weisshaupt et al. 2007, Winter and Cvetkovich 2010, Winter et al. 2009). In one study that included an assessment of property conditions, nearly all residents were found to have at least a “semi-accurate” understanding of their risk (Collins 2005). However, several studies have also indicated that while having an awareness of fire risk was important, it did not automatically lead to adoption of risk reduction behaviors (Brenkert-Smith et al. 2006, Collins 2005, Gordon et al. 2010b, Martin et al. 2007, Nelson et al. 2004).

In addition to fire risk, risk reduction behaviors are influenced by several other factors, including both personal and psychological factors and situational characteristics (e.g., local ecological conditions, residency status, conditions of adjacent properties) (Table 3). Although both types of factors have been found to influence decisions, evidence suggests that psychological factors are more influential (Absher and Vaske 2006). Psychological factors that influence adoption of treatments include: perceived effectiveness of risk reduction activities (Absher and Vaske 2006, Brenkert-Smith 2006, Bright and Burtz 2006a, Hall and Slothower 2009, Kent et al. 2003, Martin et al. 2009), self-efficacy (belief in one’s ability to complete treatments) (Bright and Burtz 2006a, Martin et al. 2009), and for some WUI residents, perceived norms (e.g., beliefs about others’ attitudes towards treatments) (Brenkert-Smith et al. 2006, Bright and Burtz 2006a).

Several studies also found that residents balance risk reduction behaviors with other values they hold for their properties, such as privacy (Brenkert-Smith 2006, Nelson et al. 2004), perceived naturalness (Collins 2009, Nelson et al.

Table 3.—Factors that influence adoption of risk mitigation activities.

Personal/psychological factors	Situational factors
Trade-offs with other values (e.g., privacy, aesthetics, naturalness, shading)	Local ecological conditions
Social norms – perceptions of others' attitudes towards treatment options	Residency status (i.e., full-time or part-time)
Perceived risk and effectiveness of mitigation options	Condition of adjacent properties
Ability to complete the risk reduction behaviors	

2004), shading (Collins and Bolin 2009, Monroe et al. 2003), providing wildlife habitat (Monroe et al. 2003, Nelson et al. 2005), and potential aesthetic impacts (although aesthetic improvements were also often cited as rationale for adopting defensible space activities) (Collins 2005, Nelson et al. 2004). WUI residents weigh the expected risk reduction benefits of treatments with the potential impacts on these other values and, in some cases, make decisions like leaving shrubs to provide screening from neighboring properties or leaving trees to provide views from windows even though they understand this action may increase their fire risk.

Several situational characteristics may also influence treatment adoption. Local ecological conditions are a consideration for many residents who have indicated a greater likelihood of adopting treatments they view as appropriate to the local ecological context (Carroll et al. 2004, Cohn et al. 2008, Nelson et al. 2005). Residency status (whether residents were part-time or full-time residents) also may influence treatment adoption. Some studies found few differences between seasonal and permanent residents (Nelson et al. 2004, Vogt 2003), but other studies found that full-time residents had more positive attitudes towards or were more likely to adopt risk reduction behaviors, particularly the more involved treatments such as tree removal (Absher and Vaske 2006, Brenkert-Smith 2010, Bright and Burtz 2006b, Deau and Vogt 2004, Martin et al. 2009). These differential rates of adoption were influenced by the time required to complete treatments (Brenkert-Smith 2010, Bright and Burtz 2006b), and at least for some seasonal residents, lower levels of financial investment and fewer valuable items (e.g., photographs, keepsakes) at risk in their seasonal homes (Brenkert-Smith 2010, Collins 2009). Absentee landowners who never or rarely visited their properties were more likely to be disconnected from the local situation and take few fire preparedness actions (Brenkert-Smith 2010, Collins and Bolin 2009). One study also found lower rates of participation among socially vulnerable populations (Collins and Bolin 2009, Ojerio et al. 2011†).

In addition, residents recognize that their risk is influenced by conditions on adjacent lands. In some cases, residents indicated conditions on nearby property motivate them to reduce fuels on their properties to be a good neighbor and do their part to contribute to shared protection (Brenkert-Smith 2010). However, in other locations residents have indicated they are unlikely to adopt risk reduction behaviors on their properties because they believe they would be ineffective given the poor condition of neighboring properties, including adjacent public lands (Cvetkovich and Winter 2008, Martin et al. 2007). This recognition of shared risks has prompted some communities to adopt cooperative, community-wide risk reduction efforts (Flint and Haynes 2006, Jakes et al. 2007b, Kyle et al. 2010, Steelman 2008a). Although such efforts were effective at influencing behavior in those locations, community-organized programs were not needed elsewhere as homeowners worked individually or with directly adjacent neighbors to take action on their properties and across property boundaries (Brenkert-Smith 2010, Kent et al. 2003). One study found that the perceived quality of relationships within a neighborhood influenced residents to seek information and take action to reduce their fire risk (Agrawal and Monroe 2006). Another study comparing adoption rates in California, Colorado, and Florida found higher rates of adoption in those communities with ordinances requiring action (Vogt 2008), although support for such ordinances is mixed across locations (Vogt et al. 2005, Winter et al. 2009).

Barriers to the Adoption of Risk Reduction Behaviors

In addition to the perceived tradeoffs between risk reduction behaviors and other values people hold for their properties noted above, residents across locations most frequently cited financial cost and time constraints as barriers to implementation (Absher et al. 2009, Collins 2005, Cvetkovich and Winter 2008, Daniel 2008, Kent et al. 2003, Martin et al. 2007). Several studies found that the time required to implement treatments was particularly important to part-time residents, who indicated they did not want to spend their limited time at their properties engaged in such activities (Brenkert-Smith 2010, Bright and Burtz 2006b).

In some locations, residents also noted the challenging nature of the work and indicated an inability to complete the work as a significant barrier (Collins 2005, Cvetkovich and Winter 2008, Daniel 2008). This perception was driven by physical limitations, a lack of knowledge about what specifically should be done at the property level, or a lack of necessary equipment. Some research suggests this was another factor on which full- and part-time residents differed; part-time residents were more likely to indicate their ability to implement treatments was a challenge (Bright and Burtz 2006b). Another often-cited barrier was the perceived incompatibility of recommended mitigation actions with the local ecological conditions (Absher et al. 2009, Kent et al. 2003, Nelson et al. 2005).

Mitigation Responsibility

When asked to indicate who is responsible for implementing protection behaviors, most residents view mitigating fire risk on their property as their own responsibility (Brenkert-Smith et al. 2006, Cohn et al. 2008, Kent et al. 2003, Martin et al. 2009, Vining and Merrick 2008, Winter and Fried 2000). Echoing findings from these studies, a national survey found a strong majority of participants agreed that if people choose to live in areas at risk of wildfires, they should be willing to accept the associated responsibility for protection of their properties (Bowker et al. 2008). While generally accepting individual responsibility, most residents also recognized their risk was influenced by the condition of adjacent lands. In several studies, participants indicated that each landowner, whether private or public, is responsible for reducing the fire risk on their property (Cohn et al. 2008, Jarrett et al. 2009, Kent et al. 2003, Vining and Merrick 2008, Weisshaupt et al. 2007, Winter et al. 2009).

Residents in several studies have also indicated they expect government agencies to provide educational materials and, in some cases, technical assistance to homeowners to raise awareness of local fire conditions and methods to mitigate fire risk (Cohn et al. 2008, Jarrett et al. 2009, Weisshaupt et al. 2007, Winter and Fried 2000, Winter et al. 2009). While multiple methods can be used to provide such information, several studies indicate interactive methods such as site visits or guided field trips are particularly effective (Monroe 2005, Paveglio et al. 2009a, Toman et al. 2006, Winter and Cvetkovich 2010, Winter et al. 2009).

THEME 2 – PUBLIC ACCEPTANCE OF FUELS TREATMENTS ON PUBLIC LANDS

This section synthesizes 83 articles on the public acceptance of fuels treatments on public lands. The following are topic areas included in this section:

- Prescribed fire and mechanized thinning
- Alternative treatments: grazing, herbicides, and no action
- Concerns with potential treatment impacts
- Factors influencing treatment approval
 - Knowledge of practices
 - Trust in implementing managers



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Key Lessons from Theme 2:

1. The public generally supports the need for fuels reduction and is at least cautiously supportive of some use of both prescribed fire and mechanized thinning.
2. Residents in the WUI generally prefer some form of active management over a no-action alternative.
3. Treatment acceptance is influenced by increased familiarity with the practice and trust in the implementing managers.
4. Concerns about escaped fires, erosion, impacts to wildlife, and aesthetics can influence treatment acceptance, but these concerns can typically be addressed by managers and are generally not as influential as familiarity with the practice and trust.

Prescribed Fire and Mechanized Thinning

Substantial research has examined public acceptance of prescribed fire and mechanized thinning. In general, studies in a variety of locations have found high levels of acceptance (more than 80 percent in many at-risk communities) of some use of both prescribed fire and mechanized thinning treatments (e.g., Absher and Vaske 2006; Brunson 2008; Lim et al. 2009; McCaffrey 2006, 2008a; McCaffrey et al. 2008; Toman and Shindler 2006b; Vogt et al. 2007). A series of studies distinguished between unqualified acceptance (legitimate tool, use anywhere) and qualified acceptance (use in carefully selected areas). Overall, thinning treatments were more likely to receive unqualified acceptance ratings from residents while acceptance for prescribed fire tended to be more qualified (Brunson 2008, Brunson and Shindler 2004, Shindler and Toman 2003, Shindler et al. 2009).

Although the majority of studies found high acceptance levels for both treatments, a few studies have found more measured levels of support; some have found lower acceptance levels for prescribed burning (Deau and Vogt 2004, Toman et al. 2011†) and others for thinning (Weible et al. 2005). For instance, a nationwide survey of the general public asked whether participants agreed or disagreed with manager use of prescribed fire and mechanical vegetation removal as part of a wildfire management program. Nearly all participants agreed with the use of prescribed fire (91%) while fewer, though still a majority (58%), agreed with use of mechanical vegetation removal (Bowker et al. 2008).

Though not universal across all studies, some findings suggest that treatment acceptance can differ depending on the specific location of treatment implementation. In these studies, participants prefer the use of mechanical thinning near developments and the use of prescribed fire in more remote locations (Bright and Newman 2006, Brunson and Shindler 2004, Ryan et al. 2006). However, one recent study found similar levels of acceptance of prescribed fire both in remote areas and around neighborhoods (Toman et al. 2011†).

The few studies that examine acceptability of letting naturally ignited fires burn to achieve resource objectives have also found higher levels of acceptance for treatments in remote areas removed from private lands (Gunderson and Watson 2007, Kneeshaw et al. 2004b, Winter and Cvetkovich 2010). One study also found that land ownership or designation can play a role in acceptance with respondents indicating a preference for use of prescribed fire on National Park Service lands versus a slight preference for use of mechanical harvest (preferably in conjunction with prescribed fire) on Forest Service and private

lands (McCaffrey et al. 2008). In Montana a survey of wilderness recreationists revealed that more than half of participants were supportive of some level of prescribed burning in Wilderness areas; local visitors were more supportive than non-local visitors (Knotek et al. 2008) (mechanical thinning was not included in the study). Limited research has examined acceptance of treatments on private lands. One survey in Minnesota found limited support for prescribed burning, mechanical thinning, or vegetation removal on private lands, but greater support for a combined approach (Vining and Merrick 2008).

Alternative Fuels Reduction Methods

Substantially fewer studies consider public acceptability of other fuels reduction methods. Here we discuss findings related to wildland fire use, grazing, and herbicides to reduce fuels and a “no action alternative.”

Managing an unplanned ignition to achieve resource benefits: Limited research has examined the public acceptance of managing unplanned ignitions to achieve resource benefits (i.e., wildland fire use). One-third to one-half of visitors to three National Forests in California, Colorado, and Washington agreed with allowing naturally ignited fires to burn when the fire was expected to result in minimal impacts to human communities or the forested ecosystems (Kneeshaw et al. 2004a). Similarly, a survey of California residents found that 60 percent agreed with allowing some fires to burn as long as residences were protected (Winter 2003). Research focused on fire managers has also described several factors that limit adoption of this practice, including psychological factors (e.g., fire managers’ tendency to favor suppression, risk of personal liability) as well as other policy-related factors (e.g., extensive planning requirements, need for specialized personnel, inability to count acres toward fuels reduction goals, inability to qualify for emergency stabilization funds should something go wrong, air quality regulations) (Aplet 2006, Dale 2006, Doane et al. 2006, Miller and Landres 2004, Williamson 2007).

Grazing: The few studies on grazing suggest it is a generally acceptable practice with roughly 80 percent indicating partial or full acceptance. Rural areas show higher proportions of respondents find the practice fully acceptable (Brunson 2008, Brunson and Shindler 2004), while more urbanized areas tend to have a higher proportion of respondents indicating partial acceptance (Brunson 2008, McCaffrey 2008a).

Herbicide use: Much lower acceptance levels are found for herbicide use; large proportions of respondents considered herbicide use unacceptable (Bowker et al. 2008, McCaffrey 2008a, Monroe et al. 2006, Toman et al. 2011†). Brunson (2008) found lower levels of support for herbicide use than for prescribed fire,

thinning, or grazing treatments. As with grazing, acceptance of some level of herbicide use differed substantially between urban and rural residents, with rural respondents being more supportive.

No action: When provided as an option, the “no action” alternative is consistently the least-preferred choice (Bright and Newman 2006, Kent et al. 2003, McCaffrey et al. 2008, Ryan and Wamsley 2008). Blanchard and Ryan (2007) found only modest support for no action. They also found more support for active management, particularly prescribed fire, on public land than on private land.

Concerns with Potential Treatment Impacts

Although acceptance levels are generally fairly high, responses also illustrate some concerns with treatment use. Concerns with treatments include the potential for an escaped prescribed burn, increased prevalence of smoke, increased erosion, reduced water quality, impacts to wildlife or aesthetics, and concern that mechanized thinning treatments may be used to promote commercial harvesting (Blanchard and Ryan 2007, Flint 2007, Jacobson et al. 2001, Laband et al. 2006, McCaffrey 2006, Shindler and Toman 2003, Vining and Merrick 2008, Winter and Fried 2000, Winter et al. 2002). It should be noted that concerns were not universal across studies and that treatments were considered as often for their potential positive impacts as negative impacts. For instance, in a survey of Northern Michigan residents Kwon et al. (2008) found that participants believed that prescribed fires would improve wildlife habitat. Similarly, Vining and Merrick (2008) found some respondents thought prescribed fires posed safety risks while others thought that they would reduce safety risk.

The potential of escape generally caused the greatest concern regarding use of prescribed fire. One study compared responses from 2001 and 2003 to examine the effects of an escaped burn on participant responses (Brunson and Evans 2005); findings illustrate the complexity of treatment acceptance. A high percentage of participants indicated the escaped burn had negatively influenced their views about the use of prescribed fire, yet actual acceptance ratings remained constant across the study period; approximately 80 percent indicated acceptance of some amount of prescribed fire use. However, other important changes emerged—participants expressed less confidence in forest managers to use prescribed fire effectively, were more concerned about fire use within 10 miles of their home, and also indicated more concern about smoke’s potential impacts on public health. Despite these increased concerns with smoke impacts, few participants (13%) indicated that prescribed fire should no longer be used due to increased prevalence of smoke.

Factors Influencing Treatment Approval

The two variables most frequently associated with fuels treatments acceptance are knowledge of a practice and trust in managers to implement it.

Knowledge/Familiarity: The most common predictor of treatment acceptance across studies is knowledge of and familiarity with the practice (Absher and Vaske 2006, Blanchard and Ryan 2007, Brunson and Shindler 2004, McCaffrey 2004a, Shindler and Toman 2003). Relatedly, some studies have also examined the influence of public outreach and education programs on treatment acceptance. Findings suggest that outreach programs can have a positive influence on knowledge and, in some cases, on attitudes toward treatments (Deau and Vogt 2004, Knotek and Watson 2006, Loomis et al. 2001b, McCaffrey 2004a, Parkinson et al. 2003, Toman and Shindler 2006a, Weisshaupt et al. 2005). Not all outreach programs are equally effective; results indicate that the success of outreach activities is influenced by both the quality of the content provided and the method by which it is communicated (McCaffrey 2004a, Toman et al. 2006). Overall, interactive formats tend to be more highly rated.

Some studies have found that higher knowledge levels are also associated with decreased concerns, particularly for prescribed fire. In Massachusetts, participants who self-reported having “some” or “a great deal” of knowledge were less concerned about effects of prescribed fire on aesthetics and impacts to wildlife and their habitat (Blanchard and Ryan 2007). The same study found respondents on Long Island, NY, who were more familiar with prescribed fire were more willing to allow its use on private lands (Ryan and Wamsley 2008). In Nevada, McCaffrey (2004a) found that those who had read educational materials on prescribed burning were more likely to think it improved wildlife habitat and diversity and less likely to agree that they did not like the appearance afterwards or that smoke caused problems for a member of their household.

Trust: Several studies have also found that citizen trust in management agencies significantly influences treatment acceptance (McCaffrey 2006; Shindler and Toman 2003; Vogt et al. 2005; Winter et al. 2002, 2006). Across this research, trust has been conceptualized in different ways; common definitions describe trust as perceived competency of agency managers to implement treatments, perceptions of shared values between public participants and agency managers, or a combination of these two approaches (Brunson and Evans 2005, Winter and Cvetkovich 2008b, Winter et al. 2004). Liou et al. (2008) found correlations between perceptions of shared values between residents and forest management agencies and support of fuels treatments; when values were perceived as being more similar, there was greater support and vice versa.

Toman et al. (2011†) found confidence in agency managers to effectively implement specific treatments (perceived competency) had the strongest influence on treatment acceptance, even when accounting for other variables (e.g., residency status, ratings of agency management, and general trust in agency managers). One study that specifically examined the relationship between trust and public opinions on fuels treatments indicated that trust is a complex concept and is influenced by multiple variables loosely categorized as shared values and norms, willingness to endorse (knowing others are acting appropriately and are responsive to feedback), and perceived competency (Liljeblad et al. 2009).

THEME 3 – HOMEOWNER BEHAVIORS DURING FIRE AND PERCEPTIONS OF FIRE MANAGEMENT PRACTICES

Homeowner behaviors during fire and perceptions of fire management actions have been a more recent area of emphasis within the fire literature. This section synthesizes 41 articles in this growing area of research. While some of these articles present empirical findings, others are conceptual in nature and draw on the broader literature in disasters and hazards to propose potential application to wildland fire. In this section, we examine emerging findings in the following areas:

- Acceptance of wildland fire management practices
- Social impacts of fire
- Communication during a wildland fire event
- Evacuation and alternatives to evacuation



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Key Lessons from Theme 3:

- 1. Wildland fires are a social as well as an ecological disturbance with potentially far-reaching impacts to surrounding communities.**
- 2. Perceptions of how a fire is managed can have a lasting influence on local citizen-agency relationships. In some cases, fires contribute to community cohesion and improved relationships while in others they result in increased tension.**
- 3. During a fire event, residents seek real-time information about the impact of the fire on their homes and property. Residents draw on multiple sources to meet their information needs.**
- 4. Limited research has examined alternatives to evacuation. Findings to date suggest a substantial change will be required in the way managers and the public view fire management for alternative approaches to be successful.**

Acceptance of Wildland Fire Management Practices

A series of papers by one research team has examined acceptance of three general fire management practices – active suppression, containment, and letting the fire burn with limited or no management intervention – under a variety of scenarios ranging from low to high impacts among forest visitors in California, Colorado, and Washington (Absher et al. 2006, 2008; Kneeshaw et al. 2004a,b). Active fire suppression was acceptable in nearly every case, while containment was also broadly accepted. Except under the lowest-impact scenarios, letting the fire burn was generally unacceptable (Kneeshaw et al. 2004a). Another study based in California found most residents agreed that fires should be immediately suppressed or managed to avoid damage to homes while few indicated they should be allowed “to take their natural course” (Winter 2003).

Citizen evaluations of how a particular fire is managed may be influenced by a variety of factors. At the broadest level, residents’ philosophies of natural resource management influenced their beliefs about appropriate fire management approaches (Rodriguez-Mendez et al. 2003). Those who supported the active management of forests believed fire was controllable and viewed resulting fire impacts as an indication of mismanagement, while others viewed fire as a natural process that should be restored.

Citizen acceptance may also be influenced by perceptions of how well local knowledge and resources were used to address the fire. In several studies, residents attributed fire impacts to the insufficient use of local firefighting resources by external agency personnel brought in to manage the fire (Carroll et al. 2005, 2006; Kent et al. 2003; Rodriguez-Mendez et al. 2003). Agency communication may also be influential; two studies found that residents whose communication needs were not met, particularly in terms of timely information on the condition of their houses, were more likely to be critical of how the fires were managed (Kumagai et al. 2004a, Taylor et al. 2007).

Social Impacts of Fire

Fires that directly threaten a community can lead to substantial psychological, physical, and financial impacts (Cohn et al. 2006, Downing et al. 2008, Rodriguez-Mendez et al. 2003). While designed to limit loss of life, evacuations themselves can result in significant stress and social disruption to residents (Cohn et al. 2006). Evacuated residents indicate substantial anxiety over the status of their homes and properties (Cohn et al. 2006, Kent et al. 2003, Rodriguez-Mendez et al. 2003) and a lack of control of ongoing events (Hodgson 2007). Evacuations may also result in reduced income if residents are unable to work (Kent et al. 2003). Limited research suggests that homeowner decisions to evacuate are influenced by a number of factors, including: the nature of the

evacuation order (i.e., mandatory vs. voluntary), the fire readiness of their homes and properties, previous evacuation experiences, and complicating factors such as ownership of pets and livestock, and age and health of family members (Cohn et al. 2006, Mozumder et al. 2008).

After the fire passes, those who have lost homes must deal with the loss of their physical assets, important documents, and family keepsakes (Downing et al. 2008). Even residents who did not lose their homes may return to find smoke damage, burned or charred landscaping and distressed vegetation, and possibly pets and livestock that have perished (Taylor et al. 2007). Moreover, their homes may now be located within a dramatically different landscape (Burns et al. 2008, Cohn et al. 2006). Following the Hayman Fire in Colorado, residents were most likely to cite changes to surrounding forest as the primary impact (Kent et al. 2003). One study examined the temporal nature of the psychological impacts of fire; focusing on adolescents, Langley and Jones (2005) found 41 percent of participants still demonstrated at least a mild level of psychological distress 10 months after a fire event, even though most (72%) had not experienced any specific losses.

In addition to these individual-level impacts, losses may result in changes at the community level. In some locations, residents have reported an increased “sense of community” as residents, local businesses, and agency personnel all worked together during and immediately after the fire event to protect their homes and the valued natural resources (Carroll et al. 2005). However, in other locations disputes over how the fire was managed have resulted in frustration among residents and blaming of fire management personnel for resulting property losses (Carroll et al. 2005, Kumagai et al. 2004c, Taylor et al. 2008). Such disputes may also amplify prior conflicts over larger questions of appropriate policies and levels of management intervention on public lands (Carroll et al. 2005).

Several articles draw on the substantial literature on hazards/disasters and propose relevant findings for the management of fires (Cohn et al. 2006, Kumagai et al. 2004b, McCaffrey 2004b, McCaffrey and Kumagai 2007). These papers make the case that much can be learned from the broader hazards/disasters literature regarding resident behaviors during and in the aftermath of a fire event. One finding that is robust across the natural hazards literature and fire research is that exposure to fire may not automatically lead to adoption of risk mitigation behaviors after the fire event (Arvai et al. 2006, Kumagai et al. 2004b, McCaffrey and Kumagai 2007).

Communication During a Fire Event

During a fire event, residents seek real-time information about the fire's status and projected future conditions to help them decide on appropriate behaviors. In the initial stages, residents seek information about the fire's location, when and how an evacuation order will be issued, evacuation procedures, and details about available services (e.g., location of shelters, availability of support to transport and board pets and livestock, where additional information can be obtained) (Cohn et al. 2006, Mozumder et al. 2008). Upon evacuation, residents want to know how the fire has affected their homes and places they care about (Carroll et al. 2006, Kumagai et al. 2004c, Taylor et al. 2007). After the fire, residents need information about when they will be allowed to return home, remaining health and safety risks, and the availability of services to help them in their recovery efforts (e.g., grief counseling, insurance, disposal of burned material, rebuilding assistance) (Taylor et al. 2007). The general complexity of a fire event often contributes to several communication challenges (Fig. 3, from Downing et al. 2008, McCool et al. 2006, Taylor et al. 2007).

In some locations, studies have identified a tension between the information needs of residents, who may seek near-continuous, specific information during a fire, and agency policies that may delay information to ensure quality control and emphasize delivery of tactical information (e.g., size of fire, resources dedicated to fire protection) (Carroll et al. 2006, Taylor et al. 2007). Residents are likely to draw on multiple information sources to address their information needs (Sutton et al. 2008, Taylor et al. 2007). Mass media sources have been cited as being overly sensational and providing inaccurate information (Sutton et al. 2008, Taylor et al. 2007). A recent study also indicates an expanding use of informal sources and social media, such as local Web sites, blogs, Internet-based forums, and mobile phones (Sutton et al. 2008).

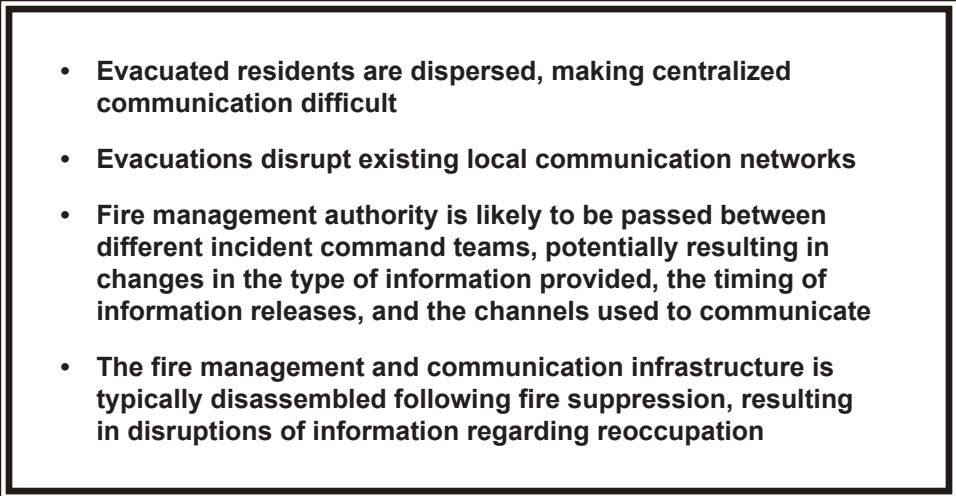
- 
- **Evacuated residents are dispersed, making centralized communication difficult**
 - **Evacuations disrupt existing local communication networks**
 - **Fire management authority is likely to be passed between different incident command teams, potentially resulting in changes in the type of information provided, the timing of information releases, and the channels used to communicate**
 - **The fire management and communication infrastructure is typically disassembled following fire suppression, resulting in disruptions of information regarding reoccupation**

Figure 3.—Communication challenges during a wildfire.

Alternatives to Evacuation

When a fire is deemed to threaten a community, the most common response in the United States is to evacuate local residents. However, the evacuation process is not without risks. For this and other reasons, managers and researchers have begun to consider alternatives to the evacuation of residents during wildland fire events (Paveglio et al. 2008, Stephens et al. 2009) (Table 4, adapted from McCaffrey and Rhodes 2009, Paveglio et al. 2008). The “Shelter in Place” (SIP) model has been used during other disasters in the United States, while the “Stay and Defend or Leave Early” approach is commonly used in Australia (McCaffrey and Rhodes 2009, Paveglio et al. 2008).

The limited available research suggests that successful adoption of either alternative in the United States will require a shift in the paradigm of fire management for both residents and fire management personnel (Paveglio et al. 2010a,b). For example, in one of the few U.S. locations where alternative plans have been developed (communities developed to shelter in place in Southern California), the local fire community disagreed on the definition of SIP and whether it should be used as a primary response or a last-ditch effort only if evacuation was not possible (Paveglio et al. 2010a). At the same time, most residents in the designated communities did not know what to do should a fire event occur (Paveglio et al. 2010a). However, research in a rural community in Idaho suggested that alternatives to evacuation could be viable in certain circumstances and with appropriate preparation (Paveglio et al. 2010b), indicating the issue warrants further exploration.

Table 4.—Alternatives to evacuation

Alternative approach	Behaviors in advance of fire	Behaviors during a fire event	Examples of where applied
Shelter in place	Prepare house and property to reduce risk of ignition	Take shelter in home for duration of event	In the United States during tornados or chemical spills
Stay and defend or leave early	Prepare house and property to reduce risk of ignition, develop fire plan that specifies whether will leave early in advance of fire or stay and actively defend property	Voluntarily leave well before a fire approaches property or actively defend property, taking shelter within the home as the flame front passes	Australia during bushfires

THEME 4 – POSTFIRE RECOVERY

This section synthesizes 32 studies that examine postfire recovery. Research on postfire social issues is relatively recent and often more conceptual in nature. Findings to date point to basic dynamics that both managers and researchers may want to consider in their future work. Topic areas covered in this research include:

- Temporal linkages across fire events
- Perceptions of risk following fire events
- Communication and outreach
- Citizen-agency interactions
- Support for postfire management activities



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Key Lessons from Theme 4:

1. **Postfire recovery begins with pre-fire planning, and is directly influenced by decisions and events that take place during the fire.**
2. **Including citizens in postfire recovery work, such as restoring trails, campgrounds, and replanting near communities, helps individuals and communities to heal from the trauma of experiencing a fire, and to reconnect with the landscape.**
3. **Interactive forms of communication concerning the postfire landscape have been very highly regarded, particularly site visits with agency personnel.**
4. **Multiple studies show high levels of support for many postfire management activities, including salvage logging, under appropriate conditions.**

Temporal Linkages Across Fire Events

A consistent theme across studies is the continuity of fire events; postfire recovery begins with pre-fire planning and is directly influenced by decisions and events that occur during the fire event (Burchfield 2007, Burns et al. 2008, Carroll and Cohn 2007, Hodgson 2007, Kent et al. 2003, McCool et al. 2006, Olsen and Shindler 2010, Toman et al. 2008a). In addition, in a review of the literature, Olsen and Shindler (2007) found that perceptions of how previous forest management decisions were made and implemented influenced public support for postfire management. Kent et al. (2003) reported that agency efforts to connect with local groups during a fire event subsequently led to the development of a partnership among forest agencies, local governments, congressional aides, and local citizens to address postfire recovery and landscape restoration and to prepare for future fire events.

Similarly, Hodgson (2007) suggested that the degree of stress and negative emotions experienced by residents during a fire event could impact the length and nature of individual and community postfire recovery. Recognizing the linkages across different stages of a fire event can help managers consider the long-term nature of potential outcomes resulting from their decisions and the ensuing dynamics in interactions with citizens (McCool et al. 2006).

Perceptions of Risk Following Fire Events

Similar to what has been found in the case of other natural hazards, experiencing a fire can lead to a variety of responses. For some individuals, the experience will increase motivation to take proactive risk reduction measures while others may experience a “post-exposure letdown” and be less likely to engage in risk reduction behaviors due to a sense of fatalism (e.g., risk reduction efforts will be ineffective as fire is uncontrollable) or a belief that such behaviors are unnecessary because “lightning doesn’t strike twice” (Arvai et al. 2006, Cohn et al. 2008, McCaffrey 2004b, Ryan and Hamin 2006).

Several variables may influence where individuals fall on this response spectrum. For example, residents may be influenced by perceptions of the severity and pattern of the fire itself. In several studies, residents have indicated they believe the likelihood of another fire to be low within the burn perimeter, but high outside the perimeter (Arvai et al. 2006, Carroll et al. 2000, Kent et al. 2003, Toman et al. 2008b). Similarly, another study found that while participants thought that another fire might occur, it would not be a high-severity fire because most of the fuels had already been consumed (Cohn et al. 2008). In other cases, residents have expressed low motivation to adopt mitigation activities because they had witnessed several homes burn in a recent fire event, even though those homes had implemented mitigation activities (Arvai et al. 2006, McGee et al. 2009, Winter and Fried 2000).

Communication and Outreach

Research has begun to identify a number of factors that contribute to successful postfire outreach efforts. The topic areas covered are an important starting point; research has shown several areas of interest to the public after a fire event (Fig. 4, Rodriguez-Mendez et al. 2003, Ryan and Hamin 2006). How messages are communicated is also important: after a fire interactive forms of communication, such as agency-led field tours, workshops, and collaborative learning, have been effectively used on multiple forests (Blatner et al. 2001, Olsen and Shindler 2007). Field tours in particular have been shown to increase understanding of what happened during the fire, forest and fire ecology, and options for postfire management (Hodgson 2007, Olsen and Shindler 2010, Toman et al. 2008b). In addition, if forests are closed for safety reasons for a long time, field tours can reduce the likelihood that conspiracy theories will develop regarding postfire management activities (Kent et al. 2003). Where field tours are not possible, visual presentations at public meetings, such as PowerPoint presentations with photographs of burned sites, have aided in understanding the complexities of postfire management (Kent et al. 2003). Additional factors that can foster communication success include:

- A designated community contact, preferably someone already known and trusted (Ryan and Hamin 2006, Toman et al. 2008a)
- Two-way communication, including asking for and utilizing forest-users' knowledge and experience in the local area (Ryan and Hamin 2006; Toman et al. 2006, 2008a)
- Use of common language and clear description of reasons for particular management actions (Ryan and Hamin 2006).

Research has revealed several focal areas on the minds of residents postfire:

- 1) Cause of fire**
- 2) How it could have been prevented**
- 3) Goals for postfire management and reasons for actions**
- 4) Postfire threats and how long they are likely to last**
- 5) Reasons for management timing**
- 6) Outcomes of restoration efforts**

Figure 4.—Postfire information needs.

Citizen-Agency Interactions

Fire events may inspire local citizens to participate in fire recovery efforts through planning or on-the-ground restoration activities (Burns et al. 2008, Carroll et al. 2005, Ryan and Hamin 2006, Toman et al. 2008a). When agencies are prepared to engage citizens and offer opportunities for them to genuinely participate in restoration efforts, citizens have reported improved relationships with agency personnel (Ryan and Hamin 2006, Toman et al. 2008a). Perhaps more importantly, many citizens have reported that participating in on-the-ground restoration activities after a fire helped them to reconnect with the forest and heal from the fire (Hull and Goldstein 2006, Ryan and Hamin 2008). Residents are particularly interested in playing a role in postfire restoration and planning in areas of interest, such as around subdivisions or in popular recreation sites (Ryan and Hamin 2006, Toman et al. 2008a).

In situations where postfire relations have been strained, researchers have found several common causes:

- Blaming over pre-fire conditions or how the fire was managed (Cohn et al. 2008, Kent et al. 2003, Rodriguez-Mendez et al. 2003)
- Perceptions of underutilization of local firefighting resources during the fire event (Cohn et al. 2008, Kent et al. 2003, Rodriguez-Mendez et al. 2003)
- Decisionmaking processes and limited involvement of citizens in planning efforts following the fire (Goldstein 2007, Olsen and Shindler 2010)

Levels of Support for Postfire Management

The postfire landscape presents new management challenges. Key considerations include identifying both desired future conditions and the most appropriate management action to get there (Carroll et al. 2000). Acceptance of management activities may vary across the landscape. For instance, an action may be favorable near communities, but not in Wilderness, or vice versa (Olsen and Shindler 2010, Ryan and Hamin 2009, Toman et al. 2008a).

Immediate postfire stabilization activities, such as erosion control, have been found to have high levels of support (Olsen and Shindler 2010, Ryan and Hamin 2006, Toman et al. 2008a). Removal of hazard trees, particularly along trails and in other public areas, also was highly supported (Ryan and Hamin 2009, Toman et al. 2008a). Broader forest management decisions, such as salvage logging and restoration actions, tend to elicit a greater range of opinions. Multiple studies have found high levels of support for some amount of postfire salvage logging (Bowker et al. 2008, Olsen and Shindler 2010, Rodriguez-Mendez et

al. 2003, Ryan and Hamin 2009, Toman et al. 2008b). One study found pre-fire perspectives on appropriate levels of forest management often carry over to the postfire landscape and influence support for salvage activities (Carroll et al. 2005). Similarly, another study found that support for salvage depended on whether the individual placed a greater ecological or economic value on the trees, and whether the individual perceived a greater risk for future fires from logging or not logging (Carroll et al. 2000). Support may also be influenced by the amount of new road construction required to extract salvaged trees and the planned harvest volume (Ryan and Hamin 2009). Many of the above studies reported preference for a balanced approach: take some burned trees for economic reasons, but also leave standing dead trees for wildlife and forest recovery.

Support for restoration activities is also mixed. Two studies find high levels of support for replanting (Olsen and Shindler 2010, Toman et al. 2008a) and seeding burned areas (Olsen and Shindler 2010). However, when asked to prioritize fuels reduction in unburned landscapes or restoration of burned forest, a majority (56%) preferred emphasizing fuels treatments, another 44 percent preferred a balanced approach, and very few (2%) indicated that managers should focus solely on restoration activities (Toman et al. 2008a). In a national survey Bowker et al. (2008) found 55 percent of respondents thought that fire-affected areas should be allowed to recover naturally. Ryan and Hamin (2006) found respondents were supportive of restoration activities near communities, but less so in the backcountry. Meanwhile, Rodriguez-Mendez (2003) found some residents viewed fires as natural and preferred minimal management intervention as the landscape recovered. The limited research available on reaching agreement on postfire management actions indicates that citizen trust in agency decisionmakers and positive citizen-agency interactions were positively correlated with acceptance of management activities (Olsen and Shindler 2010).

THEME 5 – WILDFIRE POLICY AND PLANNING

This section synthesizes 69 articles on wildfire policy and planning. Topic areas included in this research are as follows:

- Policy framework
- Collaborative planning
- Policy evaluations
 - Healthy Forest Restoration Act
 - Community Wildfire Protection Plans



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Key Lessons from Theme 5:

1. **Current fire policy has shifted away from a policy of complete fire suppression to one that includes a broader set of goals including restoring fire-adapted ecosystems, reducing wildland fuels, and providing economic assistance to rural communities.**
2. **Current wildfire policies place increased emphasis on collaborative planning. A critical factor to the success of these collaborative efforts is active participation and support by the implementing land management agency.**
3. **Lack of adequate resources (e.g., funding, qualified personnel) hampers agencies' abilities to fully implement policy goals.**
4. **Lack of institutional support for fire managers is a contributing factor in both increasing fire suppression costs and reduced wildland fire use.**

Policy Framework

The ultimate goal of wildland fire management has always been to protect human lives, property, and resources. Until relatively recently it was thought that fire suppression could meet this goal, but while fire suppression itself is largely successful at limiting fires (approximately 98 percent of fire starts are extinguished during initial attack [Dombeck et al. 2004]), it has been less effective in meeting fire policy goals (Busenberg 2004b, Wise and Freitag 2002). In fact, damage from wildfire has actually increased, in part due to fire suppression's removing a natural process that kept fuel loads in check, but also due to complex interactions among past logging and grazing practices, pest epidemics, changing climatic conditions, and a dramatically increasing WUI population (Busenberg 2004b, Carroll et al. 2007, Dale 2006, Gorte 2006).

Incremental changes in wildfire policy began in the 1970s with a recognition that fire plays an important ecological role in forest ecosystems (Aplet 2006, Davis 2001, Goldstein and Butler 2010b). In 1988, the Yellowstone fires focused the attention of the media, political officials, and the general public on wildfire management strategies and prompted reviews of fire policies (Davis 2006). A 1995 U.S. Department of Agriculture-U.S. Department of the Interior review of existing policy recognized the role of fire in ecological systems and called for implementation of fuels reduction programs to reduce the likelihood of catastrophic fire events (Stephens and Ruth 2005). A series of large wildfires in 2000 prompted additional policy revisions (Moseley 2007).

Current policy is directed by three primary documents: the National Fire Plan (2000); the Western Governors' Association 10-Year Comprehensive Plan (2001); and the Healthy Forest Restoration Act (HFRA) (2003) (Fleeger and Becker 2010, Steelman et al. 2004). More recently, the 2009 Federal Land Assistance Management and Enhancement Act mandated that federal agencies work with stakeholders to develop a national Cohesive Wildfire Management Strategy.

These current policies reflect several major changes from previous models of management. The most significant change is the shift away from a policy of complete fire suppression to one that includes a broader set of goals including restoration of fire-adapted ecosystems, reduction of wildland fuels, and provision of economic assistance to rural communities (Gorte 2003, Steelman et al. 2004). Under the suppression-centered approach, wildfire management authority rested almost exclusively with federal resource management agencies; however, more recent policies have emphasized greater intergovernmental coordination in pre-fire preparations and during-fire management (Davis 2001). Federal and state agencies are involved in determining the resources available to mitigate risk at the local level; the federal government largely sets policy direction and provides

financial resources while state governments make organization and programmatic decisions about how to allocate those resources to mitigate fire risk (Steelman et al. 2004).

Collaborative Planning

Current wildfire policies emphasize a collaborative, community-based approach to fire management (Fleeger and Becker 2010, Grayzeck-Souter et al. 2009, Steelman 2008b). Although there are many approaches to collaboration, it generally involves the coming together of diverse stakeholders to solve a problem none can achieve individually (Brummel et al. 2010, Goldstein and Butler 2010a, Sturtevant et al. 2005). The increased focus on collaboration requires a certain amount of capacity for communities to effectively participate (Steelman 2008b), which may need to be fostered in some locations. The literature reports many potential benefits to collaborative planning, including reduced conflict, identification of creative solutions, increased agreement among diverse interests, and increased capacity to accomplish objectives (Brummel et al. 2010, Sturtevant and Jakes 2008).

Several studies specifically examine collaboration in the context of wildland fire planning. In a nationwide study of fire program managers, Reams et al. (2005) found that most are participating in some form of collaborative efforts. Managers were most likely to indicate this collaboration would result in “more-effective plans” than traditional planning approaches. In addition, approximately half expected their collaborative efforts would lead to greater public support for management activities (Reams et al. 2005). In 15 case studies of wildfire planning and preparedness conducted throughout the country, Sturtevant and Jakes (2008) found that collaboration was integral to successful wildfire risk planning at the community level.

Additional research examines the success of the Fire Learning Network, which is designed to link local collaborative groups into larger regional and national networks (Goldstein and Butler 2010a,b). Leaders of the local collaborative groups meet periodically with regional partners to share successes and mistakes, receive peer reviews of their restoration plans, and build expertise. A review has found that the network has successfully contributed to the development of local expertise while supporting local collaborative efforts (Goldstein and Butler 2010a).

This is not to suggest that every decision or activity is appropriate for a collaborative approach. Drawing on the broader literature, Sturtevant et al. (2005) identified several conditions under which collaboration is unlikely to be successful (Fig. 5, adapted from Sturtevant et al. 2005).

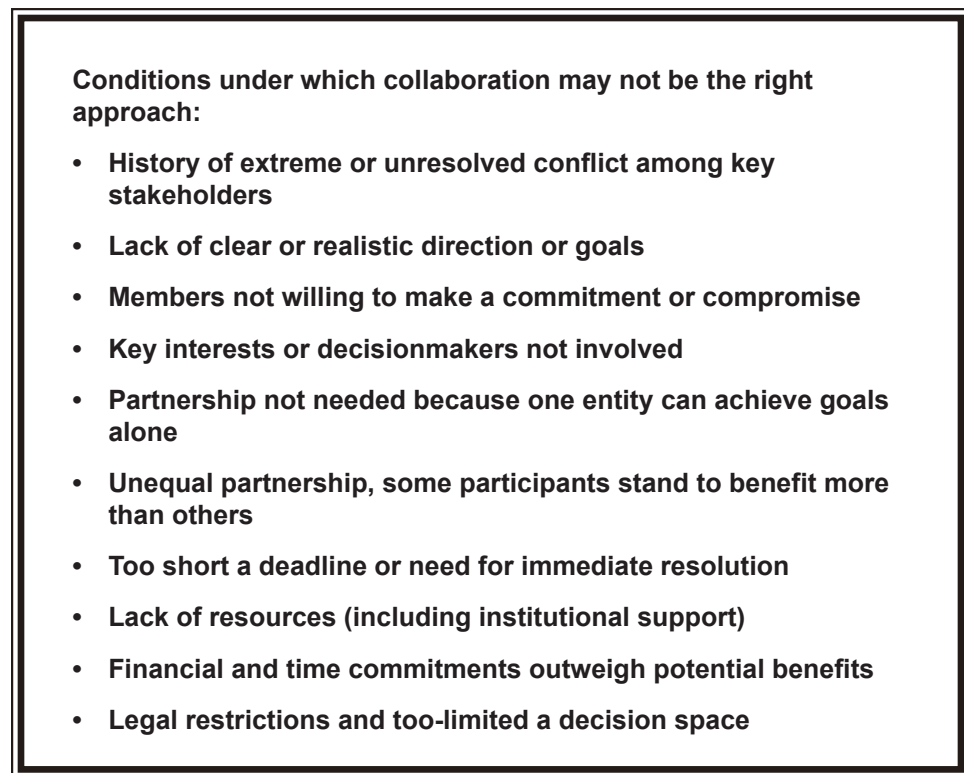


Figure 5.—Conditions under which collaboration may not be the right approach.

Policy Evaluations

Despite the shift towards a broader set of policy goals (suppression, restoration, fuels reduction, and community assistance), evaluations of fire management practices suggest that, in practice, fire suppression and hazardous fuels reduction receive the most attention and resources, sometimes at the expense of restoration and community assistance (Gorte 2003, Jensen 2006, Steelman and Burke 2007, Steelman et al. 2004). Steelman and Burke (2007) warned that these priorities could perpetuate the problems of the previous suppression-centered policy framework. To address these issues they suggest restructuring current funding arrangements to support, or at least not undermine, all goals and to place equal emphasis on performance measures for all goals (Steeleman and Burke 2007). There have been some successes in supporting the other goals; a recent review found that more local contractors were used for National Fire Plan contracts than regular contracts in three communities in California, Oregon, and Washington, suggesting some success in achieving the goal of providing community assistance (Moseley and Toth 2004, Moseley et al. 2003).

In addition to these analyses of policy goals, a small body of research has evaluated the implementation of the Healthy Forests Restoration Act and associated Community Wildfire Protection Plans (CWPPs).

Healthy Forest Restoration Act: In a content analysis of newsprint media stories on HFRA, Johnson et al. (2009) identified a mix of positive and negative articles, with slightly more expressing negative views. A consistent theme in these articles was a lack of trust in the policy itself, the underlying intentions of the office of the U.S. President that championed the legislation, and how the USFS would implement the policy. The researchers concluded that building trust would be critical to successful implementation of HFRA (Johnson et al. 2009). A study of the implementation of HFRA in three locations found that despite previous concerns, the public was included in the decisionmaking process and in two of the three cases, the resulting decisions served the general communities' broader interests (Steelman and DuMond 2009). The authors also found that fuels reduction projects implemented under HFRA were completed faster than non-HFRA projects.

Community Wildfire Protection Plans: HFRA encourages the development of CWPPs to delineate WUI boundaries, identify and prioritize hazardous fuels reduction projects, and provide recommendations to reduce structural ignitability throughout the community (Fleeger 2008, Grayzeck-Souter et al. 2009). Fuels reduction projects identified in a CWPP are exempt from full environmental review under the National Environmental Policy Act (NEPA), resulting in an expedited implementation process. As of 2009, more than 5,560 communities, or about 10 percent of federally designated at-risk communities, had completed a CWPP (Jakes et al. 2011†).

There is substantial variability in the CWPP development process (from multi-stakeholder collaboration to external consultants working with government officials) as well as in the resulting content (Grayzeck-Souter 2009). Jakes et al. (2011†) concluded that HFRA's vague requirements for CWPP development allowed for flexibility in implementation, which can be an advantage to communities that have diverse interests and needs. As for CWPP effectiveness in reducing wildfire risks on the ground, limited research suggests mixed results to date. One project found a lack of innovation in fire management approaches in CWPPs examined (Brummell et al. 2010). Another study reviewed development and implementation of two CWPPs in Oregon. At the time of the study the USFS had elected not to implement the fuels reduction plans in either location, but for different reasons. In one case the USFS had not participated in the development of the CWPP and did not choose the CWPP prescription during its NEPA analysis, and in the other case non-implementation was attributed to insufficient funds in the USFS budget (Fleeger and Becker 2010). However, a different study that surveyed state-level wildfire program managers in 11 states found that CWPPs were one of the more effective elements to overall success of programs designed to mitigate risk on private land (Renner et al. 2010). Factors contributing to successful development of a CWPP can be found in Figure 6.

Factors contributing to successful development of a CWPP:

- **Support and participation by the USFS** (or other land management agency). Not only do agency personnel supply resources and expertise, but active involvement gave the rest of the planning team confidence that the USFS would implement the plan (Fleeger 2008; Jakes et al. 2007a, 2011†).
- **A group facilitator** to help organize people and resources, and keep things moving forward (Fleeger 2008, Jakes et al. 2007a).
- **Community capacity**, including local leaders or social networks that can fully utilize and expand existing capacity (Jakes et al. 2007a, 2011†).
- **Ability to build on pre-existing groups and social networks.** Existing groups have often laid the groundwork for communication strategies and trust-building. Social networks provide access to information, skills, and resources necessary to complete the CWPP (Fleeger 2008, Jakes et al. 2011†).
- **Participants' strong commitment to the value of the collaborative process** (Fleeger 2008).
- **Trust between parties.** In cases where the community did not trust the agency, the plan contained very detailed prescriptions, removing flexibility for the agency in implementation (Fleeger and Becker 2010).
- **Galvanizing events.** In one case, two back-to-back fires served as inspiration to bring people together (Fleeger 2008).
- **Recognition of shared values**, for instance, importance of the forest to the community (Fleeger 2008).

Figure 6.—Factors contributing to successful CWPPs.

IV. CONCLUDING REMARKS

Management of wildland fires has been a central focus for U.S. federal land management agencies since their inception. The management approach has evolved over time as research on ecological, social, and technical questions has advanced our understanding of wildland fire, and as the broader context has changed. This synthesis provides an overview of key findings over the past decade of fire social science research. We conclude with a brief summary of findings and their implications for pre-, during-, and postfire management.

Collectively this body of research demonstrates that individuals, communities, policy makers, and fire management agencies are working to create fire-adapted communities. However, much work remains to be done, both in the research arena and in on-the-ground activities. Fire safety is not about eliminating fire; fire will happen on the landscape. However, communities and individuals can reduce their risk of negative consequences when wildfires do occur. As the environment changes and as more people move into natural areas, the current body of knowledge described here along with future research findings will be increasingly relevant to development of community resilience.

Management Implications in Pre-Fire Context:

Many residents in the WUI are taking action to reduce their fire risk: Many property owners in WUI communities across the United States are aware of the threat of fire and are taking action to reduce their risk. Homeowner mitigation actions include vegetation management (e.g., pruning, clearing branches from roofs, raking needles, reducing density of trees within 100 feet of home) and structural elements (e.g., use of fire-resistant building materials).

Awareness of fire risk does not automatically lead to adoption of risk reduction behaviors: Residents understand that living in the WUI carries certain risks and generally agree those risks are their responsibility. However, understanding risk does not automatically translate into risk mitigation activities. In deciding whether to take action, property owners balance their fire risk with the other values they hold for their properties and considerations of their ability to implement treatment activities. For instance, residents often report that having trees and a sense of privacy are their favorite aspects about their property—in some cases, having 30 feet of cleared vegetation around their home can seem like a direct conflict with the very characteristics they appreciate most about their property. Property owners are more likely to adopt those behaviors they perceive as compatible with their other values as well as those they believe will provide enough benefits to outweigh any perceived costs.

While adoption is high, the challenge is to ensure maintenance of activities:

Nearly all of the research on mitigation activities has focused on what people have done at one point in time, but not whether they plan to continue activities over time. While adoption is high, most risk reduction behaviors, particularly those focused on vegetation management, need to be maintained over time to be effective. Outreach programs and citizen-agency interactions can help residents understand how to remain well-adapted to their fire environment. Moreover, these behaviors can be modeled by implementing and maintaining fuels treatments on public lands near communities.

The public strongly accepts fuels treatments on public lands: Findings show that some amount of prescribed fire and mechanized thinning are acceptable to the vast majority of the public. The two factors most commonly associated with treatment acceptance are knowledge of a practice and trust in those implementing it. Contributing factors include treatment location and outcome concerns (e.g., prescribed fire escape). These findings, combined with findings that “no action” is consistently the least preferred alternative, suggest greater public support for active rather than passive management in achieving fire risk reduction goals.

Management Implications in the During- and After-Fire Context:

Wildland fires are a social as well as an ecological disturbance: Wildland fires have the potential to have far-reaching impacts on the surrounding communities. Some impacts are tangible, such as damaged homes and infrastructure, while many other impacts may be less obvious, but no less significant, ranging from the stress of evacuation and potential property loss to emotional and psychological effects from changes to the surrounding landscape.

Citizens’ attitudes, confidence in agency managers, and acceptance of agency activities are linked across the different phases of a fire event: Decisions at one point of the fire cycle can have lasting effects on citizen-agency interactions. Pre-fire planning and during-fire actions and decisions can influence recovery. Where communities and agencies have sufficiently prepared, recovery from a wildfire event is likely to proceed more smoothly than in places where little or no pre-fire planning has taken place. Perceptions of how a fire is managed can lead to increased community cohesion and strengthened agency ties following a fire event. However, the opposite can also be true; when residents perceive that a fire or immediate postfire phase is poorly managed, their confidence in agency managers or acceptance of management activities may be reduced.

Effective communication and outreach is as important during and after an event as before: Communities that reported being well informed by fire agencies during and after a wildfire event have tended to experience less negative emotion during the fire and less postfire stress. During a fire residents have an ongoing need for information on the fire's status and potential impacts on them, their homes and properties, and places they care about. The uncertainty associated with not knowing what is happening has been cited as a primary source of stress and anxiety during a fire event. Evacuations increase the communication challenge as residents disperse broadly, making it harder to provide up-to-date fire briefings.

Managers can help address these tensions by developing connections with local community groups, including homeowners' associations, Fire Safe Councils, chambers of commerce, and municipal governments prior to a fire event to facilitate ongoing communication. After a fire, people may experience numerous, often conflicting, emotions. In such situations, interactive forms of communication, particularly agency-led field tours, have been well received as they provide ways to see and understand the effects of the fire, explore fire recovery options, and share perspectives with agency personnel. In addition, if there are long forest closures for safety reasons, field tours can still allow public visitation, which can help prevent negative perceptions of the closure.

Including citizens in on-the-ground postfire recovery efforts can foster individual and community recovery: Assisting with recovery efforts allows citizens to see firsthand the effects of the fire, and gives them a tangible way to participate in the forest's recovery, which in turn can help with their own recovery. These efforts have been most successful when projects are located in popular recreation spots, around communities, in viewsheds, or in other locally important areas.

The public has high levels of support for many postfire management activities, including salvage logging, under appropriate conditions: The level of support often depends on location, values placed on the trees (economic or ecological), and the perceived risk to the forest with intervention or non-intervention. Most studies have reported finding preference for a balanced approach: take some burned trees in order to not waste them and to recoup some economic value, but also leave some standing dead trees for wildlife and shade for seedlings. Support for harvesting has also been found to be correlated with citizens' levels of trust in the agency, as well as with perceptions of how the fire was managed and handling of postfire decisionmaking. Given the time pressure of decisionmaking postfire and the potentially controversial nature of salvage logging, it is best to discuss postfire management options early, preferably prior to a fire event.

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APPENDIX I

Wildland Fire Workshop: A Decade of Social Science Research, Portland, OR, August 6-8, 2008

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APPENDIX II. SUBJECT AREA GUIDE

This subject area guide was created to support development of a compendium of social science research findings from 2000 through 2010 related to fire-adapted communities. In total, 242 articles were selected for analysis. Using an approach similar to grounded theory (a systematic methodology that applies a set of procedures to identify conceptual categories and their interrelationships—see Glaser and Strauss 1967), the research team reviewed each article, categorized key findings, and identified 12 overarching themes: acceptance of fuels management and wildland fire use; perceptions of wildfire risk; community/homeowner preparedness and mitigation; community capacity; communication and outreach; community-agency interactions; trust in management agencies; community response to wildfire and postfire recovery; wildfire impacts on recreation; institutional capacity and barriers; wildfire planning; and wildfire policy.

For the compendium, the themes were consolidated into five general topic areas. The subject area table, reflecting the original 12 themes, indicates the themes addressed in each article and provides a basic description of the methods used in each study (e.g., survey, interviews, synthesis of existing research). A basic summary of the findings for the 12 themes can be found in McCaffrey et al. 2012. A bibliography listing each paper alphabetically with a full citation and author-supplied abstract can be found on the Scholars Archive @ OSU³.

Publications in press as of December 31, 2010 are indicated by †.

³ Available at: <http://hdl.handle.net/1957/34537>

Author (see Section VI for full citation)	General methods	Pre-fire mitigation/preparedness				Community-agency dynamics			Experiencing fire		Institutional considerations	
		Acceptance of fuels mgmt/wildland fire use	Perceptions of risk	Preparedness/mitigation	Community capacity	Communication/outreach	Community-agency interactions	Trust in mgmt agencies	Community response/postfire recovery	Recreation	Institutional capacity/barriers	Wildfire planning
Eriksen and Prior 2011†	Interviews, survey		x			x						
Faulkner et al. 2009	Survey		x	x								
Fleeger 2008	Document analysis, Interviews			x							x	
Fleeger and Becker 2010	Document analysis, Interviews			x		x					x	
Flint 2007	Interviews, survey		x			x						
Flint and Haynes 2006	Interviews, survey		x	x								
Flint and Luloff 2007	Survey		x		x	x						
Goldstein 2007	Case study				x	x						
Goldstein and Butler 2010a	Document analysis, participant observation, interviews					x					x	
Goldstein and Butler 2010b	Document analysis, survey interviews					x					x	
Gordon et al. 2010a	Interviews		x									
Gordon et al. 2010b	Interviews		x									
Gorte 2003	Policy review											x
Gorte 2006	Policy review											x
Grayzeck-Souter et al. 2009	Document analysis, interviews										x	
Gunderson 2006	Focus groups, interviews	x										
Gunderson and Watson 2007	Focus groups, interviews	x										
Haines et al. 2008	Document analysis, interviews											x
Hall and Slothower 2009	Survey			x								
Hammer et al. 2009	Census data										x	
Haynes et al. 2010	Document analysis							x				x
Hodgson 2007	Application of theory							x				
Hughes and Mercer 2009	Document analysis									x	x	
Hull and Goldstein 2006	Document analysis					x		x				
Jacobson et al. 2001	Document analysis, survey	x		x		x						
Jakes et al. 2007a	Interviews										x	
Jakes et al. 2010	Interviews		x	x			x	x				
Jakes et al. 2007b	Interviews			x	x							
Jakes et al. 2004	Interviews			x			x					

Author (see Section VI for full citation)	General methods	Pre-fire mitigation/preparedness				Community-agency dynamics			Experiencing fire		Institutional considerations		
		Acceptance of fuels mgmt/wildland fire use	Perceptions of risk	Preparedness/mitigation	Community capacity	Communication/outreach	Community-agency interactions	Trust in mgmt agencies	Community response/postfire recovery	Recreation	Institutional capacity/barriers	Wildfire planning	Wildfire policy
Jakes et al. 2011†	Document analysis, interviews											X	X
Jakes and Nelson 2007	Synthesis			X	X								
Jarrett et al. 2009	Survey		X	X		X							
Jensen 2006	Policy review												X
Johnson et al. 2009	Document analysis												X
Kalabokidis et al. 2008	Interviews												X
Kent et al. 2003	Workshop, interviews	X	X	X		X	X		X	X			
Kneeshaw et al. 2004a	Survey	X											
Kneeshaw et al. 2004b	Survey	X											
Knotek and Watson 2006	Interviews	X									X		
Knotek et al. 2008	Survey	X							X				
Kolden and Brown 2010	Survey										X	X	X
Kumagai et al. 2004a	Interviews, survey						X		X				
Kumagai et al. 2004b	Application of theory		X	X					X				
Kumagai et al. 2004c	Interviews, survey					X	X		X				
Kwon et al. 2008	Survey	X								X			
Kyle et al. 2010	Survey			X									
Laband et al. 2006	Document analysis	X											
Lang et al. 2006	Interviews			X	X								
Langley and Jones 2005	Survey								X				
Lewis et al. 2011†	Interviews										X		
Liljeblad and Borrie 2006	Synthesis	X						X					
Liljeblad et al. 2009	Survey							X					
Lim et al. 2009	Survey	X											
Liou et al. 2008	Survey	X											
Loomis et al. 2001a	Survey									X			
Loomis et al. 2001b	Survey	X				X							
MacGregor et al. 2008	Synthesis		X	X									
Martin et al. 2007	Survey		X	X									
Martin et al. 2008	Survey			X		X							
Martin et al. 2009	Survey		X	X									
Mayer 2002	Document analysis										X	X	
McCaffrey 2004a	Survey	X		X		X	X						
McCaffrey 2004b	Synthesis		X	X		X							

Toman, Eric; Stidham, Melanie; McCaffrey, Sarah; Shindler, Bruce. 2013. **Social science at the wildland-urban interface: a compendium of research results to create fire-adapted communities.** Gen. Tech. Rep. NRS-111. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 75 p.

Over the past decade, a growing body of research has been conducted on the human dimensions of wildland fire. As this research has matured, there has been a recognition of the need to examine the full body of resulting literature to synthesize disparate findings and identify lessons learned across studies. These lessons can then be applied to fostering fire-adapted communities—those communities that understand their risk and have taken action to mitigate their vulnerability and increase resilience.

This compendium of social science research findings related to fire-adapted communities has resulted from a project funded by the Joint Fire Science Program. As part of these efforts, the research team reviewed more than 200 publications of research results. Then the team convened a workshop with 16 scientists who evaluated collective findings and discussed their application to support fire management activities. Within this document they describe their approach to completing this review and present key findings from the literature. The discussion is organized around five major topical areas: 1) homeowner/community mitigation, 2) public acceptance of fuels treatments on public lands, 3) homeowner actions during a fire, 4) postfire response and recovery, and 5) wildland fire policy and planning. The compendium concludes with a presentation of management implications and a bibliography of all material in this review.

KEY WORDS: wildfire, mitigation, public perceptions, evacuation, communication, acceptance of fuels treatments, postfire response, wildfire planning, wildfire policy

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