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Fire Social Science Research From the Pacific Southwest Research Station: Studies Supported by National Fire Plan Funds

Editors

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Abstract

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Fire events often have a large impact on recreation and tourism, yet these issues had not been addressed from a social science perspective. To address this, the Wildland Recreation and Urban Cultures Research Work Unit (RWU) of the Pacific Southwest Research Station acquired funding through the National Fire Plan within the community assistance topic area. The three RWU scientists have developed some distinct lines of research to address the research objectives identified when acquiring the funding: examine values/attitudes and behaviors of recreation residence owners and year-round residents in the wildland-urban interface, examine recreationists' perceptions about fire suppression and postfire forest health issues, and examine perceptions and beliefs about recreation activities and impacts to fire-prone ecosystems in the wildland-urban interface. We report 17 of these studies grouped into four major topical headings: recreation use research, communication research, program evaluation and interface residents research, and trust research.

Keywords: Recreation, wildland fire, fire management, forest visitors, forest users, wildland-urban interface.

Contents

Introduction

A U.S. Department of Agriculture Forest Service (USFS) call for research proposals in 2001 addressed rebuilding USFS capability to address problems in fire-adapted ecosystems and in the wildland-urban interface. This effort supported the National Fire Plan and the 10-year comprehensive fire strategy. The National Fire Plan goals were to ensure sufficient firefighting resources for the future, rehabilitate and restore fire-damaged ecosystems, reduce fuels (combustible forest materials) in forests and rangelands at risk, especially near communities, and work with local residents to reduce fire risk and improve fire protection (http://www.fireplan.gov).

Each proposal included the proposed research, development, and implementation activities that would be undertaken over a 5-year period, as well as the expected outcomes from these activities. The major topic headings for proposals were firefighting, rehabilitation and recovery, hazardous fuel reduction, and community assistance. Funding was distributed according to a formula developed by national team leaders within the USFS with firefighting receiving 34 percent of the funds, rehabilitation and recovery 20 percent, hazardous fuel reduction 35 percent, community assistance 10 percent, and Washington office administration 1 percent. This allocation reflected the judgment of national team leaders about the relative magnitude of needs and the alignment of the program with the National Fire Plan goals and objectives. It took into account the serious need for pivotal core fire science development and the eligibility of the social sciences across all four topics.

Fire events often have a large impact on recreation and tourism, yet these issues had not been addressed from a social science perspective.

The Wildland Recreation and Urban Cultures Research Work Unit of the Pacific Southwest Research Station was funded through this allocation within the community assistance topic area. In the proposal, we noted that fire events often have a large impact on recreation and tourism, yet these issues had not been addressed from a social science perspective. These impacts are due to the direct short- and long-term biophysical effects of fires, and indirect or induced effects owing to firefighting operations, fuel treatments, area closures, and other disruptions to social systems. Local populations are affected, as are visiting populations, and these effects are particularly acute in wildlands near urban areas. Understanding and managing these impacts would be improved by scientific study of the values, attitudes, beliefs, and behaviors of the affected populations in relation to fire events, fire management, and fire effects. Unit work focused on three research objectives:

- Examine values/attitudes and behaviors of recreation residence owners and year-round residents in the wildland-urban interface.
- Examine recreationists' perceptions about fire suppression and postfire forest health issues.

- Examine perceptions and beliefs about recreation activities and impacts to fire-prone ecosystems in the wildland-urban interface.

In the first year of funding, we developed research and cooperative relationships with people in California, Colorado, Florida, Michigan, and Washington. Our work over the years has increased considerably, and the unit has conducted research studies in many locations across the United States.

We report 17 of these studies grouped into four major topical headings: recreation use, communication, program evaluation and interface residents, and trust.

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Recreation Use Research

Chavez and Knap (2007) noted that recreation visitors to national forests and rangelands compose a demographic group that doesn't receive much research emphasis, even though it is affected by wildfire. In fact, they argued that recreation visitors might be one of the largest groups affected during, and after, wildfire events. For example, in southern California, during the 2002 Williams Fire, an estimated 2,200 recreation visitors were evacuated, and 45,000 recreation visitors and residents were evacuated during the 2003 Old Fire and adjacent Grand Prix Fire. Given that recreation visitors are affected by, and can affect fire management, they are a very important group to study. To that end, seven papers from National Fire Plan funded research cover the following topics:

- Recreational constraints owing to wildland fire and fire management based on data collected at USFS and California State Parks sites.
- Recreational constraints and place attachment.
- Effects of message type and source on visitor compliance with fire restrictions at a picnic area in southern California.
- Measurement concepts (basic beliefs, attitudes, and social norms) for understanding and predicting public acceptance of wildland fire management.
- Trusted sources for information about outdoor recreation, concern about fire and fire risk, knowledge about fire and fire risk, and similarity of values and goals between the respondents and the USFS.
- Perceptions of fire management and recreational use in urban national forests in the United States.
- Effects of fire on tourism impacts from fire on visitors to Florida counties that had recent wildfire events.

Communication Research

The five papers in this section address various aspects of communication before, during, and after wildfire events:

- The intent of communication, particularly risk communication.
- Fire communications during different stages of two wildfires, one relatively small fire of short duration and one large fire of long duration.
- Lessons learned from the large fires in southern California in 2003.
- Changing communication environment wherein citizens shape and produce the news that others receive.
- Ways to contribute to successful communication postfire.

Program Evaluation and Interface Residents Research

Two papers are offered in this section:

- User needs program assessment of the Predictive Services program, which offers products and services through Web sites, briefings, and e-mails administered through the National Interagency Fire Center and the Geographic Area Coordination Centers.
- Views about wildland fire and defensible space practices from more than 1,000 homeowners or USFS special use cabin permittees in three national forest areas.

Trust Research

There are three papers in this section:

- Approval and effectiveness ratings for potential wilderness and wildland fire management techniques.
- Southwesterners' determinations of value/action consistency, legitimacy of inconsistency, and similar salient values.
- Salient value similarity, social trust, and attitudes toward wildland fire management strategies.

Literature Cited

Chavez, D.J.; Knap, N.E. 2007. Improving fire management; what resource managers need to know from recreation visitors. Fire Management Today. 67(1): 32–34.

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Recreation Research

Big Sur Visitor Characteristics and Wildland Fire Recreational Constraints

William W. Hendricks,[1] Deborah J. Chavez,[2] and Sara S. Cohn[3]

Abstract

A study conducted with visitors to the Big Sur region of California during summer 2002 is presented. An onsite survey was administered to visitors to the U.S. Forest Service and California State Parks day-use and overnight facilities. Recreational constraints owing to wildland fire and fire management are detailed along with the effects of activity type, visitor demographics and other characteristics, and views of these constraints. Differences primarily exist in views of constraints related to regulations.

Keywords: Big Sur, wildland fire, fire management, recreational constraints, forest visitors, wildland-urban interface.

Introduction

In recent years, understanding human behavior and the social sciences' contributions to fire management has become increasingly important to natural resources managers and researchers (Hoover and Langer 2003). In response to decades of fire exclusion, an ever-increasing wildland-urban interface, and a social stigma regarding wildfires, federal agencies devised a comprehensive fire management plan (Hoover and Langer 2003). The extreme fire season of 2000 not only reinforced this need, it illustrated further research and outreach needs. The social sciences were highlighted in the fire plan as one area critically needing additional research. Managers can benefit from research regarding the influence of fire on recreation preferences (Machlis et al. 2002) to assist in wildland fire suppression and management efforts.

Although attention to the human dimensions realm of fire management has been expanding, information remains limited regarding visitors to natural resource recreation settings and their experience with fires (Borrie et al. 2006, Thapa et al. 2004). Early research by Taylor et al. (1986) found that participants in three related studies were concerned about the potential impacts of wildland fire on

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recreation values and recreation areas. People who engaged in camping, picnicking, hiking/backpacking, and nature study differed in their response to severe fires, but not to less severe fires. Similarly, in a travel-cost model testing the impacts of fires on backcountry canoeists, the canoeists preferred routes that were less severely burned (Englin et al. 1996). Three more recent studies have begun to provide some insight into the relationship between recreationists and fire. In a study of tourists and their visitation constraints to natural areas in Florida, Thapa et al. (2004) found that nearly 50 percent of the tourists surveyed would cancel trips or change destinations because of high fire danger and health concerns. Secondly, a survey of southern California urban proximate wilderness visitors (Winter 2006) led to a recommendation of increased agency education and communication regarding fire management with specified information to targeted groups. Thirdly, research with U.S. Department of Agriculture Forest Service (USFS) district rangers found that, in general, they did not perceive fire management actions as impacting the recreational activities of visitors (Bricker et al. 2005).

Among the numerous studies funded nationally related to human dimensions and fire has been a multiyear cooperative project between the USFS Pacific Southwest Research Station and California Polytechnic State University, San Luis Obispo. This paper presents data collected during summer 2002 in the Big Sur region of the California coast. The purpose of the research presented here is to examine the characteristics of visitors to the region and to determine their perceptions of recreational constraints owing to wildland fires and fire management within a fire-prone ecosystem.

Managers are often faced with the dilemma of why individuals do not participate in some recreational opportunities. Decisions of whether to participate may be based on previous experience, personal choice, or barriers and constraints to participation. Leisure constraints have been conceptualized as being intrapersonal (psychological), interpersonal (social, involvement with others), and structural (external factors that intervene between preferences and participation such as resources and facilities) (Crawford and Godbey 1987, Crawford et al. 1991).

Constraints are not universal in regard to visitor demographics or recreation activities (Jackson 1994), and the links among constraints, demographics, and types of activities have been documented in previous research. Jackson (1994) found that differences in activity types influenced perceptions of constraints. Similarly, visitor characteristics such as age (Jackson 1988, McCarville and Smale 1993, Scott and

Jackson 1996), experience (Petrick et al. 2001), income and education (Crawford et al. 1991, McCarville and Smale 1993), and gender (Arnold and Shinew 1998, Scott and Jackson 1996) have been found to affect constraints.

Clearly it is important to understand and quantify the relationship between visitor characteristics and perceived recreational constraints for specific activities or management concerns. In this case, fire and fire management is the specific area of concern.

It is important to understand and quantify the relationship between visitor characteristics and perceived recreational constraints for specific activities or management concerns.

Fire management may affect visitors from the moment they enter a park, forest, or open space area. Regulations prohibiting campfires are common during the dry season in fire-prone ecosystems, and prescribed fires are commonly used in fuel management. Studies regarding public attitudes toward fire management have usually shown a positive response to burns in general, unless the fire was caused by someone else's negligence (Cortner et al. 1984, Taylor and Daniel 1984, Zwolinski et al. 1983). With an understanding of the specific constraints experienced by visitors to Big Sur during their pursuit of recreational activities, managers can isolate areas in need of improvement, educate visitors in regard to the need for regulations, and better serve forest visitors.

Methods

Study Locale

The study took place at USFS and California State Park locations along a 60-mile stretch of Highway One on the California central coast in the Big Sur region. The region includes day-use and overnight facilities within the Los Padres National Forest and the California State Parks System. The Los Padres National Forest provides beaches, day-use areas, trails, wilderness areas, and campgrounds. In addition, the California State Park system offers day-use and campground facilities in the area. A visitor center adjacent to the main trailhead entering the Ventana Wilderness is operated jointly by the USFS, California State Parks, and the California Department of Transportation. Estimates of annual visitation to the region include 1.5 million visitors to California State Parks and the Los Padres National Forest. Approximately 70 miles from the San Jose metropolitan area, Big Sur is a popular destination for local, state, national, and international visitors. The area's scenic beauty, rugged coastline, trails, beaches, and towering redwoods have attracted visitors for nearly a century. Another notable distinction of the area is that it is prone to fires owing to its unique weather patterns, fuels, and topography (Phippen 2001).

Study Procedures

This paper, a portion of a larger study, focuses on data collected during summer 2002 on 20 randomly selected days. Randomly selected locations included three California State Parks day-use areas, one campground, and four USFS trailheads. Data collection occurred from approximately 9:30 am to 5:00 pm. The locations of data collection were randomly selected and were randomly assigned to a morning or to an afternoon period. Trained research assistants contacted visitors at the selected sites and asked individuals 18 years of age or older if they were willing to participate in the study. Participation in the study was voluntary and the subjects were assured of anonymity. Subjects completed a self-administered questionnaire onsite. The subjects included day-use and overnight visitors to the facilities. Four hundred thirty-one questionnaires were completed and returned onsite. Thirty-five individuals declined to participate in the study. The overall participation rate was 92.5 percent.

Data Analysis

Independent and dependent variables were identified for the analysis based on the study purpose. Independent variables were primarily visitor characteristics including gender, previous visit when a fire had occurred, previous visit to Big Sur, income, type of stay, marital status, and activity type. Perceived recreational constraints owing to fire and fire management were the dependent variables. Twenty-four constraints were measured on a 5-point scale (0 to 4) "not at all a barrier" to "extreme barrier" (adapted from Petrick et al. 2001).

A one-way ANOVA was used to examine differences in constraints by activity type for the three primary activities (camping, sightseeing, and hiking) pursued by the subjects during the data collection period. An ANOVA was also employed to identify differences in constraints by type of stay, income, education level, and residence. A post-hoc Tukey procedure identified significant differences among levels of variables when they were present in the ANOVA. This procedure was used to examine pairs of variable levels when a significant F test was found from the ANOVA. Finally, independent sample t-tests were used to determine statistically significant differences in constraints for gender, previous visit to an area when a fire was present, and previous visit to Big Sur.

Results

Visitor Characteristics and Activities

The 431 subjects provided an overview of their characteristics in responses to demographic items on the survey. Just over half of the subjects were male (52.7 percent), most were non-Hispanic Whites (80 percent), and many were married (53 percent). The average age was approximately 39 years, and annual household income was above $55,000 for 62 percent of the subjects. Most of the subjects were camping (64 percent), 18 percent were day-use visitors, and 16 percent were staying in a hotel or bed and breakfast. Nearly 80 percent of the subjects were residents of California and 6 percent were international travelers. Most of the subjects (74.5 percent) had previously visited Big Sur. Sixteen percent experienced a wildland or prescribed fire in a park or forest during the previous 12 months.

Two questions were designed to determine participation in activities during the subjects' visit to Big Sur. First, the subjects responded to a list of activities that they were pursuing during their visit (table 1). Secondly, from this list, the subjects identified their primary recreational activity during this visit to the Big Sur region. The most frequent activities were hiking (85.5 percent), walking for pleasure (68.5 percent), camping (65.1 percent), sightseeing (53.7 percent), wild/marine-life viewing (49.3 percent), picnicking (47.2 percent), and photography (46.0 percent). Few subjects participated in kayaking (4.9 percent), horseback riding (4.2 percent), scuba/snorkeling (3.3 percent), ocean fishing (2.3 percent), and hunting (0.9 percent). The three "primary" recreational activities by a substantial margin were camping (51.9 percent), hiking (26.6 percent), and sightseeing (14.8 percent).

Activities, Characteristics, and Constraints

The subjects were asked whether 24 perceived constraints related to fire and fire management would likely affect whether they would return to the region to participate in their primary recreational activity. Constraints were measured using a 5-point scale (where 0 = not a barrier, 1 = a slight barrier, 2 = somewhat of a barrier, 3 = an important barrier, and 4 = an extreme barrier; see table 2). Mean scores among the 24 constraints (see table 2 for complete list) were highest for "fire by arson out of control" (3.23), "fire by logging out of control" (3.22), "fire by campfire out of control" (3.09), and "prescribed fire out of control" (3.00).

Mean scores among the 24 constraints were highest for "fire by arson out of control," "fire by logging out of control," "fire by campfire out of control," and "prescribed fire out of control."

A one-way ANOVA based on the three activity types (camping, hiking, and sightseeing) determined few significant differences among mean scores for the 24 constraints for these activities. Significant differences were only present for "no fires allowed in fire pits or on cooking grills in developed campgrounds or picnic areas" at F (2, 282) = 30.26, $p < 0.001$ and for "stoves only allowed in the

Table 1—Participation in recreational activities

Activity	Participation	
	Number	*Percent*
Hiking	367	85.5
Walking for pleasure	292	68.5
Camping	280	65.1
Sightseeing	232	54.0
Wild/marine life viewing	212	49.3
Picnicking	203	47.2
Photography	197	46.0
Beachcombing	164	38.5
Driving for pleasure	163	37.9
Eating at a Big Sur restaurant	151	35.2
Swimming/wading	140	32.9
Exploring tidepools	138	32.4
Shopping in Big Sur region	106	24.7
Sunbathing at beach	95	22.1
Backpacking	73	17.0
Take dog for walk	60	14.0
Mountain biking	42	9.8
Jogging/running	39	9.1
Naturalist-led activities	33	7.7
Surfing	29	6.7
Road biking	29	6.8
Kayaking	21	4.9
Horseback riding	18	4.2
Scuba/snorkeling	14	3.3
Ocean fishing	10	2.3
Hunting	4	0.9
Other	32	10.1

Table 2—Recreational constraints

Barrier	Mean	Standard deviation
Fire by arson out of control	3.23	1.20
Fire by logging out of control	3.22	1.19
Fire by campfire out of control	3.09	1.24
Prescribed fire out of control	3.00	1.26
Natural fire out of control	2.63	1.41
Decreased air quality from smoke	2.27	1.30
Traffic delays fire suppression	2.24	1.23
Brush burning logging operations	2.24	1.23
No fires in pits/grills in developed areas	2.12	1.49
Brush burning from homeowner	2.06	1.39
Campground closures due to fire	2.02	1.26
Decreased visibility of scenic beauty due to smoke	1.98	1.31
Trail closures due to fire	1.91	1.25
Fire suppression taking place	1.88	1.27
Picnic area closures due to fire	1.75	1.26
Visible smoke from fire	1.59	1.32
Visible burned area	1.44	1.25
No fires/stoves in backcountry	1.32	1.47
Natural fire burning for ecological benefits	1.30	1.25
Prescribed fire for ecological benefits	1.20	1.21
Stoves only in backcountry	1.03	1.33
Fire permit requirement in backcountry	0.99	1.33
No smoking except in designated areas	0.64	1.22
Prohibit fireworks	0.36	0.97

Score has a 5-point scale where 0 = no barrier to 4 = extreme barrier.

backcountry" at F (2, 282) = 3.19, $p < 0.05$. Camping had a significantly higher score (mean [M] = 2.75) than hiking (M = 1.70) and sightseeing (M = 1.34) for the former, and camping (M = 1.10) scored significantly higher than sightseeing (M = 0.65) for the latter.

T-tests and an ANOVA were conducted to examine differences in constraints relating to three characteristics of the visitors: whether or not the subjects had previously visited Big Sur, if they had experienced a prescribed or wildland fire in a park or forest during the previous 12 months, and the type of accommodation (overnight camping, day use, or hotel/bed and breakfast). The *t*-tests based on visitation to Big Sur found significant differences for "a fire started by arson that is out of control," (M = 3.32 previous Big Sur visit, M = 3.00 no visit) "no fires allowed

in fire pits or on cooking grills in developed campgrounds or picnic areas," (M = 2.25 previous Big Sur visit, M = 1.83 no visit) and "no smoking except in designated campground areas" (M = 0.73 previous Big Sur visit, M = 0.44 no visit) at $p < 0.05$. *T*-tests conducted regarding experiencing a fire during previous visitation to a park or forest showed significant differences for 5 of the 24 constraints items at $p < 0.05$. Differences were present for "decreased air quality from wildland/prescribed fire smoke" (M = 2.32 no fire experience, M = 1.96 fire experience), "visible burned areas from a wildland/prescribed fire" (M = 1.48 no fire experience, M = 1.13 fire experience), "visible smoke from a wildland/prescribed fire" (M = 1.64 no fire experience, M = 1.25 fire experience), "a prescribed fire set for ecological benefits" (M = 1.24 no fire experience, M = 0.91 fire experience), and "a natural fire being allowed to burn for ecological benefits" (M = 1.34 no fire experience, M = 0.97 fire experience). There were four constraint items with significant differences for the accommodation type. Overnight campers were more likely to perceive constraints for "no fires allowed in fire pits or on cooking grills in developed campgrounds or picnic areas" (F [2, 403] = 36.57, $p < 0.004$), "no fire/stoves in the backcountry" (F [2, 402] = 5.71, $p < 0.001$), "stoves only in the backcountry" (F [2, 400] = 9.59, $p < 0.001$), and "permit requirement for campfire/stove in the backcountry" (F [2, 403] = 4.57, $p < .011$). For all items, overnight campers scored significantly higher constraint levels than day-use visitors and hotel/bed and breakfast users except for the permit requirement where the difference was only significant with day-use visitors.

Demographics and Constraints

Visitor demographics of gender, income, education, and residency were also examined for their effects on constraints.

Gender—

Gender had a more profound influence on constraints than any other variable with 14 of 24 items exhibiting a significant difference between females and males (table 3). Scores for females were higher on items relating to fire suppression and control; whereas, scores for males were higher on items pertaining to regulations.

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Income—

Annual household income was treated as four discrete categories for ANOVA procedures: $35,000 and under, $35,001 to $55,000, $55,001 to $75,000, and more than $75,000. Four of the 24 items demonstrated significant differences: "A natural fire being allowed to burn for ecological benefits" (F [3, 389] = 3.33, $p < 0.02$), "brush burning from logging operations" (F [3, 392] = 3.74, $p < 0.011$)," no fire/stoves in the

Table 3—Gender differences in recreational constraints

Barrier	Female	Male	*p* value
Fire by arson out of control	3.42	3.07	.003
Fire by logging out of control	3.43	3.03	.001
Fire by campfire out of control	3.30	2.90	.001
Prescribed fire out of control	3.22	2.82	.001
Natural fire out of control	2.87	2.42	.001
Decreased air quality from smoke	2.55	2.02	.001
Traffic delays due to fire suppression	2.38	2.12	.032
Brush burning logging operations	2.32	2.18	.302
No fires in pits/grills in developed areas	2.18	2.07	.474
Brush burning from homeowner	2.08	2.05	.811
Campground closures due to fire	2.21	1.84	.003
Decreased visibility of scenic beauty due to smoke	2.27	1.73	.001
Trail closures due to fire	2.05	1.78	.025
Fire suppression taking place	1.99	1.78	.099
Picnic area closures due to fire	1.88	1.63	.042
Visible smoke from fire	1.79	1.42	.005
Visible burned area	1.55	1.36	.112
No fires/stoves in backcountry	1.10	1.53	.003
Natural fire burning for ecological benefits	1.41	1.21	.099
Prescribed fire for ecological benefits	1.33	1.10	.055
Stoves only in backcountry	0.99	1.07	.545
Fire permit requirement in backcountry	0.91	1.06	.281
No smoking except in designated areas	0.48	0.79	.010
Prohibit fireworks	0.27	0.44	.076

Score has a 5-point scale where 0 = no barrier to 4 = extreme barrier.

backcountry" (F [3, 387] = 3.04, $p < 0.029$), and "permit requirement for campfire/stove in the backcountry" (F [3, 387] = 6.53, $p < 0.001$). Except for "a natural fire being allowed to burn for ecological benefits," individuals with income levels under $35,000 had significantly higher scores than one or more of the other income levels.

Education—

Three levels of education (high school education or less, college education, graduate school) were used for ANOVA procedures. Significant differences were found for "no fires allowed in fire pits or on cooking grills in developed campgrounds or picnic areas" (F [2, 403] = 4.44, $p < 0.012$), "no smoking except in designated campground areas" (F [2, 404] = 4.42, $p < 0.013$), and "permit requirement for campfire/stove in the backcountry" (F [2, 405] = 3.03, $p < 0.049$). For all three constraints, those with a graduate school education had lower constraints scores than the other two education levels.

Residency—
The ANOVA indicated two constraint items with significant differences between California residents, other U.S. residents, and international visitors. California residents were more likely to perceive constraints for "no fires allowed in fire pits or on cooking grills in developed campgrounds or picnic areas" at F (2, 406) = 4.44, $p < 0.001$ and "no fire/stoves in the backcountry" at F (2, 407) = 3.05, $p < 0.048$. Differences were present between California residents and the other two groups for the first constraint and between California residents and international visitors for the second constraint.

Discussion

This research set out to study perceived recreational constraints owing to fire management and wildland fires. Subjects responded to an onsite survey conducted within the Big Sur region of the California central coast. The intent of the research was to examine the effects of a number of visitor demographics and characteristics on perceptions of constraints and to determine the constraints that were perceived barriers to participation in recreational activities.

The constraints with the highest mean scores were all related to fires that were described as out of control.

The constraints with the highest mean scores were all related to fires that were described as "out of control" regardless of the initial cause of the fire. However, there was a distinct order to these mean scores with fires that might be perceived as having less desirable sources receiving the higher scores. The two highest rated barriers were "a fire out of control by arson" and "a fire by logging operations that is out of control." The lowest rated out-of-control fire was started by natural causes. Although it seems that an out-of-control fire would be a consistent constraint to recreational activities regardless of the source, it appears that preconceived notions and attitudes might influence these perceived constraints. This supports the need to understand the public's attitudes toward fires in developing fire policies (Manfredo et al. 1990) and the implication that the public, including visitors to natural resource recreation areas, have an effect on fire management decisionmaking and policies. Ultimately, fire management perceptions may be based on the values of these visitors (Bright et al. 2003).

For most of the independent variables, only a few constraint items emerged as statistically significant differences among levels of the variables. However, regardless of the visitor characteristic or demographic treated as an independent variable, significant differences were usually present for constraints that could be construed by visitors as regulations. Many of these differences were probably due to the functional nature of the activity. For example, it is not surprising that campers would rate regulations higher than sightseers for constraints relating to

fire restrictions within a campground of backcountry setting. Nevertheless, it is essential to understand compliance or a lack of compliance with regulations by visitors to successfully carry out fire management strategies (Winter 2003).

One exception to the trend of most constraints being based on regulations was gender, with half of the constraint items demonstrating gender differences. This supports much of the previous leisure constraints research that has found that women often feel more constrained than men when engaging in leisure (Arnold and Shinew 1998). These results may have considerations for critically reviewing the proportion of survey participants (male v. female) or the composition of community groups who should be involved in fire management planning to determine if representative viewpoints of the constituency demographics are present. More importantly, further investigation is necessary to determine why females rate the constraints higher than males on numerous items relating to fire and fire management and why males rate regulations as higher barriers.

Another independent variable that differed in its effect on recreational constraints was the influence of experiencing a wildland/prescribed fire during the previous 12 months. Rather than significant differences relating to regulations, these distinctions revolved around the actual presence of fires and ancillary causes such as decreased air quality, visible burned areas, visible smoke, and ecological benefits. However, contrary to previous research, the subjects who had not experienced a fire had higher constraints scores on these items. Machlis et al. (2002) suggested that the perception of threats from fires should increase with more experience. It may be that additional information concerning the type of fire experienced and the severity of the fire is necessary to understand why these experienced individuals have lower perceptions of constraints relating to fires. It is also plausible, that once experienced, these factors are no longer a barrier in a natural resources recreation setting. The experience of recreationists with fires could be distinctly different than the experiences of community members in a fixed location.

The study highlights the importance of considering and understanding the perceptions of visitors to natural resource recreation areas.

This research provides a glimpse of the effects on visitors of perceived recreational constraints caused by fire management and wildland fires. The study highlights the importance of considering and understanding the perceptions of visitors to natural resource recreation areas in adopting fire management strategies, techniques, planning models, policy setting, and decisionmaking. Specifically, the findings suggest that managers consider providing detailed information about the reasons that certain regulations are imposed, how fire suppression activities are implemented for “out of control” fires, and what actions visitors should take when they find themselves in a scenario confronting a wildland or prescribed fire that

presents potential constraints to their planned recreational pursuits. Furthermore, information and marketing programs that provide visitors with access to suggestions for alternative areas or forests for a planned visit would be helpful.

Metric Equivalents

1 mile = 1.61 kilometers

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Place Attachment and Recreational Constraints Relating to Fire Management

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Abstract

This paper presents a study of visitors to the Big Sur region of California during summer 2001. An onsite survey was administered to visitors to USDA Forest Service day-use areas and at developed campgrounds. Place attachment, observations relating to fires and fire management, and perceived recreational constraints owing to wildland fire and fire management are examined. The results indicate that place dependence and place identity influence some perceived constraints and observations of fire conditions. A discussion of the findings is provided, emphasizing the importance of managers' understanding of visitors' perceptions relating to fire and fire management.

Keywords: Big Sur, wildland fire, fire management, recreational constraints, place attachment, forest visitors, wildland-urban interface.

Introduction

Since 2000, management of fire-prone ecosystems has received substantial attention in the United States. The awareness of wildland fires has been particularly evident among communities and land management agencies since the significant loss of life, property, and structures during the 2000 fire season. Subsequently multiple federal land management agencies developed a National Fire Plan to guide policy development and to emphasize the need to conduct research relating to biological, physical, and social aspects of fires (Machlis et al. 2002). The experience of visitors within the wildland-urban interface is among the areas emphasized in this research agenda.

The purpose of this study was to examine the effects of place attachment on perceived recreational constraints owing to fire and fire management and visitors' observations of fire and fire management activities.

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One potential means of comprehending visitors' perceptions concerning fire management is to investigate the attachment they have to places.

The perceptions of visitors to natural resources recreation areas concerning fire management actions, policies, and practices may depend on a number of individual and societal characteristics, experiences, feelings, and values. One potential means of comprehending visitors' perceptions is to investigate the attachment they have to places.

Although various approaches to the study of place attachment have emerged in recent years, one accepted conceptualization by outdoor recreation researchers has been the measurement of two dimensions of attachment: place identity and place dependence (e.g., Williams 2000; Williams and Roggenbuck 1989; Williams et al. 1992, 1995 [4]). Place identity refers to the symbolic or emotional attachment that individuals have toward a place emphasizing their feelings, values, beliefs, behaviors, attitudes, and norms (Proshansky et al. 1983). Place dependence represents the functional nature of the attachment, the goals that individuals pursue at a place, and their assessment of alternative places to pursue these goals (Stokols and Shumaker 1981). In essence, visitors to a place that is a natural resource may value it because they can participate in recreational activities at that destination (Moore and Graefe 1994).

A benefit of examining place attachment is that it may provide an understanding of how management practices or alternatives are viewed by recreationists (Bricker and Kerstetter 2000). Previous research has demonstrated that place attachment helps managers to not only understand visitors, but to determine how they might respond to natural resources management issues (Kyle et al. 2003, Warzecha and Lime 2001). Therefore, the attachment that visitors have to a particular natural resources recreational setting may shape their perspectives on fire management. In fact, it has been argued that "the type and degree of attachments that people hold in regard to specific public lands influence their views of fire stewardship" (Knotek, 2006: 24).

Leisure constraint is another concept that researchers commonly use to understand recreationists. Constraints have been defined as "factors that limit people's participation in leisure activities, people's use of leisure services, or people's enjoyment of current activities" (Jackson and Scott 1999: 300). Although three types of constraints are typically recognized (interpersonal, intrapersonal, and structural) (Crawford and Godbey 1987, Crawford et al. 1991) in this research we are particularly interested in structural constraints that intervene between preferences and participation.

A multidimensional concept, structural constraints are particularly relevant to natural resources management issues. A focus on structural constraints has been emphasized previously (e.g., Scott et al. 2006). Structural constraints are similar to

[4] Williams D.R.; Anderson, B.S.; McDonald C.D.; Patterson, M.E. 1995. Measuring place attachments: more preliminary results. Paper presented at the National Recreation and Park Association, Leisure Research Symposium. San Antonio: TX.

Jackson's (1993) conceptualization of barriers (Shores and Scott 2005) or external factors that a visitor does not have control over (Scott et al. 2004, Shores and Scott 2005). These constraints are external to the recreation participants, and they may be imposed or managed (Bialeschki and Henderson 1988). For example, the timing of a prescribed fire may create a constraint to participation in planned recreational activities for visitors to a specific forest.

The connection between barriers and constraints has long been established in previous research and discussions of leisure constraints (e.g., Henderson and Bialeschki 1993, Jackson 1994, Norman 1991, Petrick et al. 2001, Shores and Scott 2005, Tierney et al. 2004). The most direct relationship found in previous studies is possibly the use of barriers by Petrick et al. (2001) to directly measure constraints. In a study of golfers' constraints, motivations, and previous experience, they measured constraints using a 5-point Likert-type scale (from "not a barrier" to "extreme barrier"). We adapted this conceptualization and measurement of constraints because of its utility in a specific recreational setting and its precedence for investigating constraints with a segmentation of subjects (in Petrick et al. 2001, the segmentation was by experience use history; for our research it is place attachment).

Methods

Study Site

The study took place during summer 2001 near Big Sur on the central California coast, a 60-mile region along Highway One that offers unique recreational opportunities within one of the most spectacular natural resource destinations in the United States. Scenic views, world-class surfing, and ideal coastal camping likely ensure that many Big Sur visitors develop significant emotional ties and a sense of attachment to the region. The coastal redwood forest, approximately 30 miles from Monterey and 70 miles from Santa Clara County with a population of 1.5 million, also lies on a wildland-urban interface and has a high level of fire danger annually. Periodically, areas in the forest are closed owing to wildland fires.

Sampling

Visitor perception data were collected on 15 randomly selected days and at seven randomly selected U.S. Department of Agriculture Forest Service (USFS) day-use, beach, and campground areas using random probability sampling procedures with replication. Locations were randomly assigned to a morning or afternoon. Based on a Los Padres National Forest recreation manager's estimates of visitor proportions, a target of 66.6-percent weekend days and 33.3-percent weekdays was selected for data collection. Research assistants approached all visitors at each of the selected

locations during a period and asked if they were willing to participate in the survey. The subjects were assured of anonymity and were informed that their participation in the study was voluntary.

Instrument

The subjects completed onsite a 5-page questionnaire. Survey items included demographics and visitor characteristics such as annual household income, education, racial category, gender, residency, marital status, previous visitation to Big Sur, and accommodations. Of particular interest to this project were place identity and place dependence dimensions of attachment measured using an 11-item, 5-point scale from 1 = strongly disagree to 5 = strongly agree, with 3 as neutral. Five items measured place dependence and six items measured place identity. Sixteen perceived recreational constraints were measured using a 5-point scale: 0 = not a barrier, 1 = a slight barrier, 2 = somewhat of a barrier, 3 = an important barrier, and 4 = an extreme barrier (adapted from Petrick et al. 2001). The constraint items were developed based on consultation with USFS managers, social scientists, and a fire ecologist. Finally, frequency of observance of 11 fire-related conditions during visits to Big Sur were measured on a scale of 1 = not at all, 2 = sometimes, 3 = often, 4 = very often, and 5 = extremely often (adapted from Hammitt et al. 1996). The subjects also had the option of choosing "not applicable."

Analysis

For the data analysis, high and low levels of place identity and place dependence were created using the 50th percentile as a divider. These categories were treated as two levels for a *t*-test with place identity and place dependence as independent variables and the 16 perceived constraint items as dependent variables. Similarly, the effects of place dependence and place identity on visitors' observations of 11 fire-related conditions were also examined.

Results

The survey was administered to 498 subjects visiting Big Sur during July and August 2001. Over half of the subjects were male (56 percent) and over half were married (53 percent). Respondents were approximately 38 years old, and most had an education level equivalent to completion of a 4-year college degree. There were rather disparate annual household income levels with 38.4 percent of the subjects with incomes above $75,000 and 24.2 percent of the subjects with incomes $35,000 and lower. The majority of the subjects maintained a residence in California (80 percent), although 6 percent were international visitors. Most of the subjects had

visited Big Sur previously (77 percent), an average of four times. Most subjects were camping overnight (77.8 percent). Other subjects were day-use visitors (12.5 percent) or individuals staying in a hotel/bed and breakfast (7.7 percent). The majority of subjects described their racial categories as White (78.4 percent), American Indian/Alaskan Native (2.3 percent), Mexican (2.3 percent), Asian (2.1 percent), and other (8.3 percent).

Mean scores were calculated for the place attachment dimensions of place dependence and place identity (table 4). The highest mean scores for place attachment were "Big Sur is very special to me" at 4.02, "Big Sur means a lot to me" at 3.72, and "Big Sur is a part of me" at 3.63, which all represent the place identity dimension. Inter-item reliability of the six place identity items and the five place dependence items indicated acceptable alpha coefficients of 0.92 and 0.90 respectively.

The highest mean scores for place attachment were "Big Sur is very special to me," "Big Sur means a lot to me," and "Big Sur is a part of me," which all represent the place identity dimension.

Table 4—Place attachment to Big Sur

	Mean	Standard deviation
Place identity:		
Big Sur is very special to me	4.02	0.87
Big Sur means a lot to me	3.72	0.97
Big Sur is a part of me	3.63	0.99
I am very attached to Big Sur	3.57	0.98
I identify strongly with Big Sur	3.55	1.02
Visiting Big Sur says a lot about who I am	3.23	1.02
Place dependence:		
No other place can compare to Big Sur	3.59	1.12
Big Sur is the best place for what I like to do	3.57	0.89
I get more satisfaction out of visiting Big Sur than from visiting any other place	3.11	0.99
I wouldn't substitute any other area for doing the types of things I do at Big Sur	3.08	1.04
Doing what I do at Big Sur is more important to me than doing it in any other place	3.02	0.95
Overall place attachment	3.46	0.80

Note: 5-point scale: 1 = strongly disagree to 5 = strongly agree.

The importance of barriers for a return visit to Big Sur or a similar destination were identified for 16 perceived constraint items relating to fire management, wildland fires, and prescribed fires (table 5). Perceived constraints with the highest mean scores were "no fires allowed in fire pits or on cooking grills in developed campgrounds or picnic areas" ($M = 2.21$), "decreased air quality from smoke" ($M = 2.16$), "traffic delays due to fire suppression" ($M = 2.13$), and "decreased visibility

Table 5—Perceived recreational constraint means by place attachment dimensions

Barrier	Overall	Persons with: Low identity	Persons with: High identity	*p* value	Persons with: Low dependence	Persons with: High dependence	*p* value
		- - - - - Mean score - - - - -			*- - Mean score - -*		
No fires in pits/grills in developed areas	2.21	2.08	2.33	0.082	2.14	2.25	0.453
Decreased air quality from smoke	2.16	2.00	2.33	.007	2.03	2.27	.052
Traffic delays due to fire suppression	2.13	2.05	2.22	.161	2.01	2.24	.052
Decreased visibility of scenic beauty due to smoke	2.00	1.92	2.09	.167	1.88	2.10	.974
Campground closures due to fire	1.92	1.78	2.08	.021	1.78	2.04	.522
Fire suppression activities taking place	1.51	1.34	1.70	.004	1.32	1.68	.003
Trail closures due to fire	1.50	1.35	1.64	.008	1.32	1.64	.003
Visible smoke from fire	1.50	1.41	1.58	.160	1.39	1.59	.87
No fires/stoves in backcountry	1.40	1.27	1.51	.078	1.37	1.40	.837
Picnic area closures due to fire	1.39	1.29	1.50	.079	1.28	1.49	.076
Visible burned area	1.17	1.04	1.30	.023	1.03	1.29	.023
Stoves only in backcountry	1.08	1.07	1.07	.964	1.09	1.05	.735
Fire permit requirement in backcountry	.96	.91	.98	.558	.95	.93	.835
No smoking except designated areas	.42	.35	.48	.200	.40	.42	.834
Prohibit fireworks	.17	.18	.16	.701	.12	.21	.126

Note. 5-point scale: 0 = not a barrier to 4 = an extreme barrier, significant differences at p <0 .05.

due to smoke" (M = 2.00). The lowest mean scores were for "prohibition of fireworks" (M = 0.17), "no smoking except in designated areas" (M = 0.42), and "permit requirement for campfire/stove in the backcountry" (M = 0.96).

An estimate of the frequency of observance of fire conditions during visits to Big Sur indicated low ratings of all 11 observations from a range of "not at all" observed to "sometimes" observed (see table 6). The highest mean score ratings were for "prohibition of fireworks in the forest" (M = 1.94), "evidence of a wildland fire" (M = 1.78), and "campfire rings next to a trail" (M = 1.72).

T-tests were conducted to examine the effects of high and low levels of place identity on perceived recreational constraints owing to fires and fire management (table 5) and the observance of fire conditions (table 6). Significant differences emerged between low and high levels of place identity for constraints for "decreased air quality from wildland/prescribed fire smoke," "campground closures due to fire," "fire suppression activities," "trail closures due to fire," and "visible burned areas from a wildland/prescribed fire." For all five of these items, high identity mean scores were greater than low identity mean scores. Similarly, there were significant differences for the effects of identity on 8 of the 11 observance items where high identity resulted in higher mean scores than low identity.

Table 6—Means for observances of fire conditions by place attachment dimensions

Condition observed	Overall	Persons with: Low identity	Persons with: High identity	*p* value	Persons with: Low dependence	Persons with: High dependence	*p* value
	- - - - - *Mean score* - - - - -				- - *Mean score* - -		
Prohibit fireworks in forest	1.94	1.70	2.18	0.006	1.81	2.05	0.176
Evidence of wildland fire	1.78	1.57	1.95	.001	1.56	1.92	.001
Campfire rings next to trail	1.72	1.60	1.80	.069	1.70	1.74	.756
Restrictions no fires backpacking	1.64	1.40	1.83	.001	1.44	1.77	.005
Restrictions no fires in grills/pits	1.60	1.54	1.65	.234	1.52	1.66	.111
Evidence of prescribed fire	1.59	1.38	1.76	.001	1.39	1.73	.001
Evidence campfires nondesignated area	1.59	1.45	1.70	.005	1.46	1.67	.018
Visible smoke prescribed fire	1.58	1.43	1.71	.003	1.43	1.69	.004
Visible smoke wildland fire	1.49	1.41	1.57	.030	1.43	1.54	.144
Wildland fire suppression	1.42	1.31	1.57	.013	1.30	1.50	.012
Large bonfires in forest	1.17	1.20	1.15	.464	1.21	1.14	.280

Note: 5-point scale: 1 = not at all to 5 = extremely often observed; included not applicable option; significant differences at $p < 0.05$.

Differences occurred for "prohibit fireworks in forest," "evidence of wildland fire," "restrictions no fires backpacking," "evidence of prescribed fire," "evidence of campfires in non-designated area," "visible smoke prescribed fire," "visible smoke wildland fire," and "wildland fire suppression."

T-tests were also used to determine the effects of place dependence on perceived recreational constraints (table 5) and observance of fire conditions (table 6). High place dependence scores were significantly higher than low dependence scores for three constraints items: "fire suppression activities," "trail closures due to fire," and "visible burned areas from a wildland/prescribed fire." For observation of fire conditions, there were significant differences between high and low dependence scores for "evidence of wildland fire," "restrictions no fires backpacking," "evidence of prescribed fire," "evidence of campfires in non-designated area," "visible smoke prescribed fire," and "wildland fire suppression."

Discussion

The focus of this research was to assess perceived constraints that forest visitors face that are caused by fire management activities and wildland fires, the frequency of observed conditions related to fires and fire management, and the relationship of these constraints and observations to place attachment.

As demonstrated in other studies, the attachment that individuals have to the places they visit and recreate in continues to be an important variable in understanding recreationists. The analyses in this research provide support for

this assertion. The subjects with higher levels of place attachment continuously exhibited higher levels of perceived constraints and observations of fire conditions.

It is possible that the wording on the questionnaire regarding constraints influenced these results. The subjects were asked to consider the constraints from a perspective of visiting Big Sur again or an area like Big Sur. If the subjects did not plan on revisiting Big Sur or a similar natural recreation area, the perceived constraints relating to fires and fire management may have been irrelevant.

In viewing the overall observation of fire condition scores, it is apparent that the scores are relatively low with the most scores in the "sometimes observed" range. Thus, even during summer 2001 following the severe 2000 fire season, most of these subjects were not cognizant of fire regulations or evidence of fires. At the time of this data collection in 2001, the most recent large-scale fire at Big Sur was the Kirk Complex Fire of 1999. The low scores may simply have been because of a lack of personal experience with wildland fires by the subjects participating in the study.

Another plausible outcome of these results is that additional informational and interpretive programs are necessary to educate many visitors about Big Sur as a diverse and complex fire-prone ecosystem. The highest perceived constraint was not allowing fires in pits or on cooking grills in developed campgrounds or in picnic areas. Most of the subjects in the study were staying in developed campgrounds. Traditionally and culturally, campers have grown accustomed to the expectation of a fire as a part of the camping experience. Interpretive programs could be designed that emphasize the benefits of camping without a fire such as wildlife observation, the ecosystem benefits of leaving downed wood in place, and the reasons that regulations are in place during times of extreme fire danger. Communication strategies targeting the public need careful planning, and the delivery of these messages is an especially important consideration (Toman et al. 2006).

Ultimately, the constraints that visitors confront may have a profound impact on the quality of their visits and their perceptions of managerial, social, and environmental conditions in natural resources recreation settings.

This study offers additional understanding of visitors to a specific natural resources recreation region and underscores the importance of considering visitor perceptions, observations, and how their perspectives impact the implementation of policies and management of natural resources (Kyle et al. 2004). Ultimately, the constraints that visitors confront may have a profound impact on the quality of their visits and their perceptions of managerial, social, and environmental conditions in natural resources recreation settings.

Metric Equivalents

1 mile = 1.61 kilometers

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Visitor Compliance With Fire Restrictions: An Observational Study Using Verbal Messages and Symbolic Signage

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Abstract

The purpose of this study was to examine the effects of message type and source on visitor compliance with fire restrictions at the Applewhite Picnic Area, Cajon Ranger District, San Bernardino National Forest, California. Six treatments were administered during summer 2005 involving verbal messages (awareness of consequences and altruistic messages) and signage for primarily Hispanic recreation visitors. Six treatment groups were assigned: sign only, sign/verbal moral, sign/verbal fear, no sign/verbal moral, no sign/verbal fear, and no sign/no verbal (control). During treatments using signage, two signs containing "no fire" symbols were posted in each experimental zone. Visitor behavior was recorded by independent observers using a Behavior Anchored Rating Scale and grouped into three general compliance categories: superior compliance, marginal compliance, and poor compliance (n = 263). The results, using a 2 × 3 ANOVA, indicated (a) a significant interaction effect between signage and messages, (b) a significant difference between message types with a fear appeal having significantly higher compliance scores than a moral appeal, and (c) no significant difference between a sign and no sign. The results may assist land and recreation managers in developing effective informational programs related to fire safety and regulations that successfully influence visitor behavior.

Keywords: Persuasive communication, fire management, wildland-urban interface.

Introduction

Fire management strategies have changed dramatically over the past 40 years, ranging from all-out suppression at the turn of the century to the use of prescribed burns and fire management techniques in the 1970s (Taylor et al. 1986). The severity of the 2000 season highlighted the lack of a comprehensive understanding of

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fire regimes, and demonstrated the limiting affects of continued fire suppression on investigations into environmental and social interactions with fire management. In response, the federal government developed the National Fire Plan. This investigation into fire management strategy was focused on protecting the needs of both communities and the natural environment (National Fire Plan 2001). Pursuant to the National Fire Plan, the National Wildfire Coordinating Group released a report in 2001 illustrating the role social sciences could play in fire management strategies. Specifically, social science methodologies could investigate public values, attitudes and behaviors, and the efficacy of public communication efforts in relation to fire and fire management (Hoover and Langer 2003).

Outdoor recreation has been, and will continue to be, popular across most segments of the population in the United States (Cordell et al. 1996, Douglas 1999). However, the social landscape of outdoor recreation in America is constantly changing. Observed shifts have been due in part to increased participation, changes in participant ethnicity/race, and increased open space accessibility. As natural resource recreation visitors become more diverse and active, researchers must provide managers with studies describing the specific recreational values of each user group to direct effective management strategies (Cordell et al. 2002, Virden and Walker 1999). Social science methodologies can serve as a guide to assist managers in meeting the needs of the recreation participants and to understand and mitigate for the impacts associated with increased use including crowding, vandalism, and increased fire danger (Manning 1999, Roggenbuck and Berrier 1982).

Persuasive communication is a theoretical social psychology framework developed to understand effective methods of changing attitudes or behaviors (Manfredo 1992). Petty and Cacioppo (1981) and Ajzen (1992) suggested a breakdown of the key factors that affect the reception of a message. These factors include message source, target receiver group, message channel, message type, and situational variability. The influential qualities of these factors have been investigated, and results indicate each factor must be manipulated for a particular setting and management concern. For example, various persuasive communication channels have been used to influence visitor behavior in outdoor recreation settings. These channels may include signage (Al-Madani and Al-Janahi 2000, Chavez et al. 2003, Davies et al. 1998, Dwyer et al. 1989), fear-based and morality-based verbal appeals (Christensen 1981, Hendricks et al. 2001, Johnson Tew and Havitz 2002, Oliver et al. 1985, Roggenbuck and Berrier 1982, Vander Stoep and Gramann 1987), bulletin boards (McCool and Cole 2000), brochures (Lime and Lucas 1977, Martin 1992, Oliver et al. 1985, Roggenbuck and Berrier 1982), or informational slide shows (Morgan and Gramman 1989). Often, in order to find the most influential message

for a particular area or user group, researchers have studied these techniques in conjunction (Oliver et al. 1985, Roggenbuck and Berrier 1982). Verbal appeals and written appeals, whether through signage, brochures, or bulletin boards, have been generally shown to decrease depreciative behaviors in outdoor recreation settings (Burgess et al. 1971, Christensen 1981, Cole 1998, Manning 2003, Martin 1992, Oliver et al. 1985, Samdahl and Christensen 1985). However, little research has been devoted to the persuasive message factors that may influence, and in turn opportunities to manage for, fire-related depreciative behaviors. In addition, analyses of the persuasive properties of symbolic signage have yet to be conducted for wildfire management, although such analyses are commonly used in the field of recreation and land management (Chavez et al. 2003).

The purpose of this study was to understand the types of persuasive messages that most effectively influence visitor compliance with fire restrictions in a southern California national forest.

The purpose of this study was to understand the types of persuasive messages that most effectively influence visitor compliance with fire restrictions in a southern California national forest. This study investigated three questions regarding the use of fear- and moral-based verbal appeals, and symbolic signage on the primarily Hispanic visitors to a day-use area at the wildland-urban interface:

1. Is there a difference between moral and fear verbal appeals in gaining visitor compliance with fire restrictions?
2. Does a "no fire" symbolic sign influence visitor compliance?
3. Do messages and signage interact to explain compliance with fire restrictions?

The results and implications of this study may provide land managers within the southern California area data regarding fire-associated visitor behavior, particularly for Hispanic visitors. In addition, this study may provide useful data for managers overseeing areas with similar environmental and demographic characteristics. The goal in both cases is to aid in the construction of management campaigns to reduce fire hazards associated with human use of outdoor areas.

Methods

The study took place at the Applewhite Picnic Area (AWPA) at Lytle Creek in the Cajon Ranger District of the San Bernardino National Forest (SBNF), 15 miles west of the city of San Bernardino. The picnicking areas are on either side of a half-mile-long, meandering parking lot that spans the entire site. Lytle Creek is located on the south side of the parking lot with approximately half of the picnicking sites following the creek. Past investigations into the typical user group for AWPA have shown that visitors are primarily Hispanic groups of up to 15 people. These groups usually arrive in the morning, reserve a picnicking area, and stay until late in the afternoon (Chavez 2002).

A Behavior Anchor Rating Scale (BARS) was developed to measure the level of compliance as the dependent or response variable (1 to 3: noncompliance, 4 to 6: marginal compliance, 7 to 9: superior compliance) (Cronbach 1990). This type of BARS allowed research assistants to note individuals' behavior at the time of occurrence and to determine the rating that best described the action (Cronbach 1990, Hendricks et al. 2001). Prior to data collection, the rating scale was reviewed and revised, based on comments by San Bernardino National Forest land managers and policymakers, to ensure the example actions were realistic and accurate.

Six treatment groups were assigned: sign only, sign/verbal moral, sign/verbal fear, no sign/verbal moral, no sign/verbal fear, and no sign/no verbal. During treatments using signage, two signs containing "no fire" symbols were posted in each experimental zone. Six weekend days were randomly selected for data collection between June 25th and July 25th of 2005. The picnic area was divided into zones at either end of the half-mile parking lot. Because each zone was at the far end of the picnic area, the layout allowed for two treatments to be administered during the same time block. However, based on low visitor usage on some weekend days, some treatments were administered one time only. In addition, research assistants conducted visitor counts at the beginning and end of each treatment day.

Verbal messages were administered by two female Spanish-speaking research assistants and the messages were directed to the oldest male member of the group because of predefined cultural-based gender roles (Alvirez and Bean 1976, Chavez 2003, Hutchison 1987). Assistants were dressed in plain clothes, but identified themselves as U.S. Department of Agriculture Forest Service (USFS) volunteers. The verbal moral appeal focused on the effect of defined restricted actions on the surrounding environmental and social communities. The verbal fear appeal focused on the effect of certain behaviors on the individual who performs those actions such as alerting the individual that certain behaviors may result in fines or punishment. Signs were posted on existing speed-limit and "no parking" signs, as these signs were highly visible to visitors. The sign showed a flame with a red slash over the symbol (fig. 1). This symbol was designed to communicate that fire and open flames were restricted. The symbolic signage design followed the sign guidelines in *Sign and Poster Guidelines for the Forest Service* (USDA FS 1998).

During the treatments, observers rated behaviors on a 1 to 9 scale describing three types of compliance: noncompliance, marginal compliance, and superior compliance. The ratings were then treated as interval data and analyzed using an analysis of variance (ANOVA). Following an ANOVA, treatment comparisons were conducted using a Dunnet T3 analysis.

Figure 1—U.S. Department of Agriculture, Forest Service symbol used to make "no fire" symbolic signs for the experimental treatments.

Results

Two hundred and sixty-three observations were recorded between June 25 and July 18, 2005. Approximately 1,500 people visited the area on the weekends during the 6-week period, and most users picnicked on Sundays. On days when both treatment zones were open, more than 400 people entered the AWPA. The average group size was 11, and the largest recorded group consisted of 30 people. A majority of users, approximately 85 percent, were Hispanic. Families usually barbequed all day, played and lounged by the creek, and included multigenerational groups. In many cases, more than half of the group were children. Groups tended to socialize with neighboring families, and most visitors spent the warmer parts of the day by the creek even if picnicking in other areas of the AWPA. Observers noted visitors often littered, and litter was observed to increase on windy days. The use of fireworks was not noted at any time.

Approximately 53 percent (n = 139) of all behavioral observations were rated as "superior compliance." The most often recorded "marginal compliance" behavior was unattended barbeques (n = 60), followed by observations of visitors causing large grill fires (n = 17). Fifteen recorded occurrences, approximately 6 percent of all behaviors, included the burning of litter or wood, and was the third most common example of behavioral "noncompliance" (table 7).

The ANOVA results showed verbal messages were significantly different than other treatments in influencing compliance (table 8). According to the analysis of variance and the Tukey analysis (table 9), a verbal fear appeal differed from both the verbal moral treatment and no verbal appeal. Compliance ratings associated with exposure to symbolic signage was not significantly different from the control (no sign/no verbal) (table 8). In addition, the use of signage and verbal appeals in conjunction appear to significantly affect compliance ratings, decreasing or increasing mean compliance ratings when compared to sign only and verbal only treatments (see table 10).

Approximately 53 percent of all behavioral observations were rated as superior compliance. The most often recorded marginal compliance behavior was unattended barbeques, followed by observations of visitors causing large grill fires.

Table 7—Frequencies of reported actions

Reported actions	Reports	
	Number	*Percent*
Noncompliance:		
Burning natural resources or trash	15	5.7
Use of personal grill on vegetation or creek	11	3.1
Open fire/flame left unattended while barbequing near vegetation or creek	5	1.9
Smoldering ashes of litter dumped near vegetation or creek/water spout	3	1.1
Marginal compliance:		
Barbecue left lit or unattended while barbecuing	60	23.8
Large fire with personal or provided grill	17	6.5
Propane barbeque near vegetation or on the ground	11	3.1
Cigarette butts extinguished and tossed near vegetation or creek	1	.4
Ashes extinguished and dumped in picnic area	1	.4
Superior compliance:		
Barbecuing with provided grills	62	23.6
No fire or flame left unattended	43	16.4
Safety with propane or personal grill	34	12.9

Table 8—Two-way ANOVA and Dunnet T3 significance testing

Source	DF	Sum of squares	Mean square	F	p value
ANOVA					
Signage	1	0.795	0.795	0.14	0.707
Verbal appeals	2	67.41	33.70	6.00	.003
Signage × verbal appeals	2	49.84	29.92	4.43	.013

Table 9—Tukey's test for multiple comparisons

Comparison	Difference between means	Significant at $\alpha = 0.05$
Fear appeal v. no verbal	1.151	Yes
Moral appeal v. no verbal	0.328	No
Fear appeal v. moral appeal	0.822	Yes

Table 10—Frequencies and percentages of compliance

Treatment	Poor compliance		Marginal compliance		Superior compliance		Mean compliance rating
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	
Control	7	16	16	38	19	45	6.19
Sign	0	0	4	44	5	55	6.67
Verbal fear	9	9	25	25	67	66	7.13
Verbal fear/sign	1	3	3	9	29	88	8.33
Verbal moral	1	4	7	27	18	69	7.27
Verbal moral/sign	9	17	16	31	27	52	6.29

Conclusions

Overall, the results of this study indicate the use of verbal appeals may be an effective strategy to communicate fire regulations and influence visitor behavior. According to the analysis, the fear appeal used in this study was quite effective. Moreover, our fear appeal used in conjunction with symbolic signage produced the highest mean compliance ratings. Compliance scores associated with the use of symbolic signage did not significantly differ from mean compliance ratings recorded for the control. This may be due in part to the presence in the area of small symbolic signs posted on bulletin boards and the USFS ongoing campaign to reduce fire hazards at the wildland-urban interface. The USFS posted signs are smaller representations of an open flame with a red slash through it, and are posted by the restrooms during the spring and summer months. The signage treatment applied in this study included larger versions of these signs posted in more visible areas.

Verbal messages were more effective than the signage treatment or control in influencing visitor behavioral compliance with fire restrictions.

According to mean compliance ratings, verbal messages were more effective than the signage treatment or control in influencing visitor behavioral compliance with fire restrictions. Verbal moral and verbal fear messages showed meaningful compliance differences, with verbal moral showing higher compliance. Verbal fear appeals caused higher frequencies of superior compliance when used with symbolic signage than did verbal moral appeals with signage.

The results of this study indicate that the use of both types of verbal appeal increases visitor compliance with fire restrictions when compared to the control and signage only scenarios. Verbal fear messages used in this study were shown to be an effective method of influencing visitor compliance especially when used with signage. The verbal moral appeal used in this study was less influential when used in conjunction with signage than the verbal moral appeal alone. Generally speaking, superior compliance activities were frequent prior to the application of experimental treatments, during the control treatment; AWPA visitors seem to be aware of fire restrictions and appropriate behavior. Managers of the San Bernardino National Forest may consider including the application of verbal appeals during periods of high fire danger to further increase compliance. This study indicates that the verbal fear message specifically, in conjunction with the current use of symbolic signage, may increase visitor compliance with fire restrictions during the spring and summer months. To further ensure compliance, USFS managers could continue to intermittently patrol the picnic area to show a law enforcement presence and possibly deter the small number of irresponsible visitors.

The results of this study provide encouraging data regarding visitor behavior within the AWPA and within the southern California region. However, research could be extended to provide further clarification on behavioral compliance with

fire restrictions and to expand on previous research regarding visitor characteristics and recreation preferences. Recommendations for further research include the replication of this study with other racial/ethnic groups, the use of other fire symbols as signage, and the use of other message sources. Messaging overload should also be investigated in this context to describe the effect of multiple channels of "no fire" messages. In addition, different verbal appeals could be tested using tailored messages that address specific "noncompliance" behaviors such as the burning of natural resources.

Metric equivalents:

1 mile = 1.61 kilometers

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Basic Beliefs, Attitudes, and Social Norms Regarding Wildland Fire Management in Southern California

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Abstract

This study presents three measurement concepts (basic beliefs, attitudes, and social norms) for understanding and predicting public acceptance of wildland fire management. These concepts often drive agency wildland fire management policies and influence public behavior. Using cognitive hierarchy as an underlying theoretical framework, measures of fire-specific basic beliefs, attitudes, and situation-specific social norms toward wildland fire management were examined. Data were obtained from a mail survey sent to a random sample of visitors to the San Bernardino National Forest (SBNF). Analyses indicated the reliability of (a) five basic belief scales related to wildland fire management (biocentrism, anthropocentrism, freedom, capability/trust, responsibility), (b) an attitude indicator (wildland fire as benefit or harm), and (c) three situation-specific normative measures (put the fire out, contain the fire, let the fire burn) of acceptance of fire management. Regression analyses demonstrated that basic beliefs and attitude variables were useful in understanding public acceptance of fire management actions. Discussion of the relationships among these concepts provides insight regarding support of forest visitors for different fire management activities in the SBNF and offers some insight into further action needed to develop this line of research further.

Keywords: Wildland fire, public perceptions, beliefs, social norms, fire management.

Introduction and Background

The San Bernardino National Forest (SBNF) is located in southern California adjacent to the Los Angeles metropolitan area and is classified as an "urban forest" with an extensive wildland-urban interface (WUI). Thousands of homes and businesses are adjacent to or within the SBNF. Much of this development is contained within small communities and private housing tracts. The SBNF

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is dominated by chaparral and shrublands on the lower slopes and open coniferous forest above 6,000 feet. The climate is Mediterranean: mild winters with infrequent, short rainy periods and long, hot summers without significant precipitation. The landscape is both fire-prone and fire-dependent. Historically, fires were frequent and of low to moderate intensity. Fuel buildup over recent decades combined with prolonged drought has made the SBNF especially susceptible to catastrophic wildfires. One fire in 2003 burned 91,281 acres, destroyed 940 homes and cost six lives (Blackwell and Tuttle 2004). Reviews of federal firefighting efforts have emphasized the need to work with local communities and better understand the social influences on the perceptions and decisions of those living in the WUI (GAO 2007, Rey 2007). Public acceptance of wildland fire policies and associated management actions is thus important.

Recent studies of wildland fire beliefs and attitudes suggest that psychological variables are important to understanding public tolerances for wildland fire policies.

Recent studies of wildland fire beliefs and attitudes suggest that psychological variables are important to understanding public tolerances (i.e., norms) for wildland fire policies (Absher and Vaske 2007, Absher et al. 2006, Winter et al. 2002). Clarifying the cognitive relationships among these factors (beliefs, attitudes, norms) is especially important for areas like the SBNF where the vegetation systems are diverse and the residents have distinct local lifestyles. This paper uses cognitive hierarchy as a foundation for predicting the variable relationships.

Conceptual Framework

The cognitive hierarchy suggests that one's personal view of the environment is shaped by values, value orientations (i.e., patterns of basic beliefs), attitudes, norms, and behaviors (Fulton et al. 1996, Vaske and Donnelly 1999, Vaske et al. 2001). These components build upon each other beginning with fundamental values (the center of one's personal belief system) and ending with specific behaviors (e.g., homeowner defensible space activities, public support for management actions). Fundamental values are defined as enduring concepts that are used to evaluate the desirability of specific modes of conduct or the ends achieved through such conduct (Rokeach 1973). Values are general concepts and do not have a specific referent. People hold relatively few fundamental values (dozens) that are slow to change. These values inform basic beliefs about a cognitive referent (e.g., wildland fire), which in turn lead to situation-specific beliefs, attitudes, norms, and behaviors.

Basic Beliefs

Basic beliefs related to natural resource issues have been applied to wildlife management (Bright et al. 2000, Fulton et al. 1996), forest management (Vaske and Donnelly 1999, Vaske et al. 2001), and wildland fire management (Bright et al.

2003, 2005). This study examined five basic beliefs regarding wildland fires that are evident in popular and scientific literature. These dimensions represent key value-based cognitions that drive public perceptions of wildland fire management in situation-specific contexts.

The first two dimensions draw from the work of Vaske et al. (Vaske and Donnelly 1999, Vaske et al. 2001) and include the basic beliefs of anthropocentrism and biocentrism. **Anthropocentrism** reflects the extent to which the benefits to humans are of primary concern regarding natural resource and environmental management. **Biocentrism** refers to the extent to which the health and welfare of ecosystems and their components (e.g., habitat and wildlife) are of primary concern in natural resource management.

The next three dimensions can be traced to Rokeach's (1973) description of fundamental values. **Freedom** focuses on independence and free choice, and, in the context of wildland fire management, refers to the extent that private landowners should be free to, or constrained from, such actions as building private residences in or near the urban-wildland interface where wildfire may occur or properly managing the vegetation in or around their home. **Capable/Trust** draws on concepts of competence and effectiveness. Relative to wildland fire management, it reflects the extent to which the public "trusts" the ability of public agencies to effectively manage wildland fire (Vaske et al. 2007). **Responsibility**, as applied to wildland fire management, addresses who is responsible for protecting homes built in or near the WUI, and who is responsible for managing the risk of wildland fire (e.g., private landowners, public agencies, both).

Attitudes

Attitudes have been scientifically investigated by social psychologists for half a century and have been a focal point of several wildland fire management studies (Absher et al. 2006, Bright et al. 2007, Manfredo et al. 1990). Although alternative definitions of the concept have appeared in the literature, most definitions agree that an attitude involves an evaluation of some object (e.g., wildland fire). For example, does the public perceive wildland fires to be beneficial or harmful to the environment? Are wildland fires seen as positive or negative?

Social Norms

Over the past two decades, at least 30 studies have examined norms toward natural resource management issues (for reviews see Donnelly et al. 2000, Shelby et al. 1996, Vaske and Donnelly 2002, Vaske and Whittaker 2004). In these studies, norms are defined as evaluative standards (acceptability measures) regarding

individual behavior or conditions in a given context. As demonstrated here, such evaluative standards may also refer to the acceptability of collective or institutional behaviors (e.g., an agency's policy regarding fire management).

Different contexts produce different evaluative standards for what is acceptable.

Research has shown that different contexts produce different evaluative standards for what is acceptable (Taylor et al. 1988, Wittmann et al. 1998, Zinn et al. 1998). An understanding of public acceptability norms for wildland fire management necessitates explicit reference to both geographic place and the specific conditions that caused the fire. Fire-specific situations previously developed and empirically tested (Kneeshaw et al. 2004a, 2004b) were used to represent combinations of factors believed to influence support for fire management alternatives. These situations differed in terms of the source of the fire and fire impacts on air quality, private property, forest recovery, and outdoor recreation.

Methods

Sampling and Data Collection

The target population was visitors to the SBNF. Visitors were approached at a variety of sites, including day use, campground, visitor center, trailhead, and roadside sites (e.g., overlooks). A total of 829 individuals completed a one-page, onsite survey, and agreed to complete a followup mail questionnaire about perceptions of wildland fire and its management. Mail survey participants first received the 12-page questionnaire, a prepaid postage return envelope, and a personalized cover letter explaining the study. Ten days after the initial mailing, a reminder postcard was sent. A second complete mailing was sent to nonrespondents 10 days after the postcard reminder, and a third mailing of the questionnaire was sent 1 month following the second complete mailing. A total of 321 completed surveys were received (response rate = 321 / [829 sent – 53 nondeliverables] = 41 percent). As a check on potential nonresponse bias, onsite respondents who completed the mail survey were compared against the onsite respondents who did not return the mail survey. For all the variables on the onsite survey (the dependent variables), the Hedge's *g* effect sizes were < 0.2, indicating only a "minimal" relationship (Vaske et al. 2002). Nonresponse bias was thus not considered to be a problem, and the data were not weighted.

Basic Belief and Attitude Measurement

Five basic belief dimensions were measured (anthropocentricism, biocentricism, responsibility, capable/trust, and freedom). Each dimension was based on an additive index containing three to five questionnaire items. The five basic belief indices

were measured on 7-point scales ranging from "strongly disagree" (1) through "no opinion" (4) to "strongly agree" (7). Details on item wording are presented in Bright et al. (2003). The attitude measure benefit/harm asked whether wildland fires in national forests, parks, and other natural areas are bad/good, harmful/beneficial, and negative/positive. The three items in the attitude index employed 7-point semantic differential scales ranging from "extremely bad, harmful, and negative" (1) to "extremely good, beneficial, and positive" (7). As demonstrated elsewhere (Bright et al. 2003, 2005), confirmatory factor analysis of these basic belief/attitude dimensions provided a good fit to the data.

Social Norm Measurement

Consistent with previous work (Kneeshaw et al. 2004a, 2004b), norms for wildland fire management were rated in eight specific scenarios that described potential effects of a new wildland fire in the SBNF. The scenarios manipulated five situational factors related to wildland fires. Each factor had two levels (table 11): origin of fire (lightning vs. unintentionally caused by humans), impact on air quality (not affected vs. poor air quality), risk of private property damage (low vs. high), forest recovery (few vs. many years), and impact on outdoor recreation in the forest (remain open vs. closed for the season). With five factors and two discrete levels each, 32 scenarios would have been necessary to represent a full factorial design. To reduce respondent burden, an orthogonal array (a subset of all possible scenarios) was constructed using SPSS (Statistical Package for the Social Sciences) Conjoint 10.0.[4] This reduced the number of scenarios necessary to eight (table 11). This fractional factorial design only considers main effects and assumes that interactions are negligible.

Following the presentation of each scenario, three common management alternatives in the urban-wildland interface were rated for acceptability within that scenario context. The three management actions included (1) immediately put the fire out, (2) let the fire burn but contain it so it does not get out of control, and (3) let the fire burn out on its own without trying to contain it (referred to below as "put fire out," "contain fire," and "let fire burn," respectively). Respondents rated each of the 24 management actions (8 scenarios × 3 management actions) on 7-point scales ranging from "highly unacceptable" (-3) through "no opinion" (0) to "highly acceptable" (3).

[4] The use of trade or firm names is for reader information and does not imply endorsement by the U.S. Department of Agriculure of any product or service.

Table 11—Fire management scenarios by situational factors

Scenario	Origin of fire	Air quality	Private property damage	Forest recovery	Outdoor recreation
1	Lightning	No effect	High risk	Many years	Closed
2	Humans	Poor air	Low risk	Many years	Closed
3	Lightning	No effect	Low risk	Quick	Closed
4	Humans	No effect	High risk	Many years	Open
5	Lightning	Poor air	High risk	Quick	Open
6	Humans	Poor air	High risk	Quick	Closed
7	Humans	No effect	Low risk	Quick	Open
8	Lightning	Poor air	Low risk	Many years	Open

Results

Reliability analysis (Cronbach's alpha) was used to examine the internal consistency of the scales (table 12). Alphas ranged from 0.66 to 0.92. Overall, the basic belief and attitude dimensions were considered reliable. Respondents' ratings of the items in each dimension were used to compute the latent concepts.

Respondents valued the rights of nature more than the benefits that humans might derive from nature.

Table 12—Basic beliefs and attitude measures: overall forest data

Belief	Mean[a]	Standard deviation	Items	Number	Alpha
Biocentrism	6.00	1.34	4	315	0.86
Anthropocentrism	2.32	1.15	5	314	.78
Freedom	4.13	1.53	3	313	.75
Capable/trust	5.04	1.23	3	313	.77
Responsibility	3.98	1.23	4	311	.66
Benefit/harm	3.89	1.70	3	298	.92

[a] All items are measured on a 7-point scale ranging from "strongly disagree" (1) through "strongly agree" (7).

The SBNF visitors were more biocentric ($M = 6.00$) than anthropocentric ($M = 2.32$) in their orientation toward forest management. In other words, respondents valued the rights of nature more than the benefits that humans might derive from nature. On average, respondents trusted the U.S. Forest Service management of forests and believed in their ability to effectively manage wildland fires (capable/trust $M = 5.04$). All other belief and attitude scales averaged slightly above the middle of the range (3.89 to 4.13). These ratings suggest that a range of basic beliefs and attitudes exist within the population for responsibility, freedom, and benefit/harm of wildfire. Taken together, the results reveal a belief structure for the SBNF, which can be compared against other forests to gauge regional or situational variation in cognitive structures.

Figure 2 displays the mean acceptability ratings for each management action by scenario. (The scenario order from table 11 has been changed to graphically display the pattern of differences.) Positive mean ratings represent "acceptable" management actions and negative means represent "unacceptable" management actions. The higher the mean score, the more "acceptable" the action; the lower the mean score, the less "acceptable" the action.

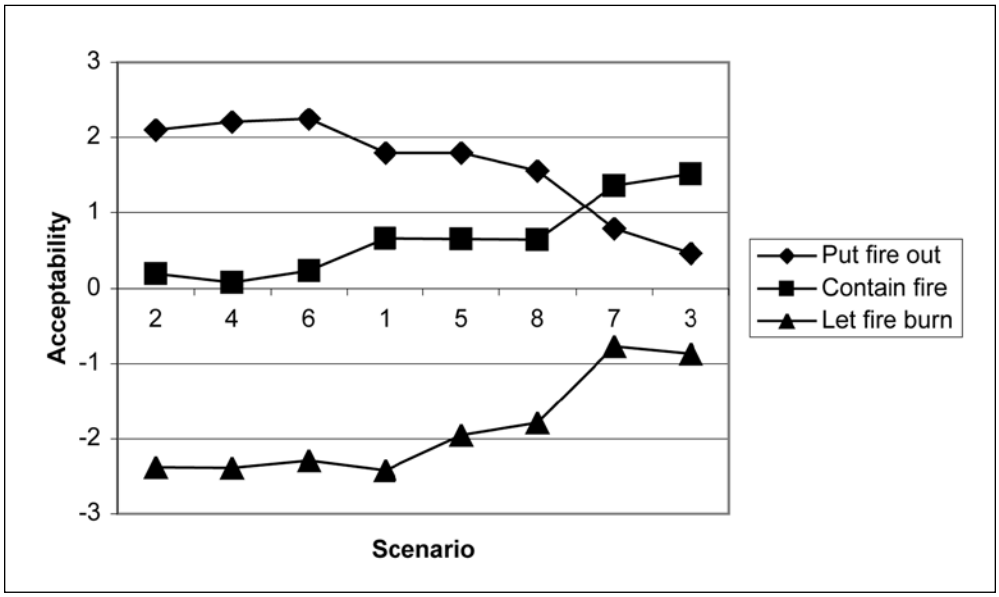

Figure 2—Fire norms: acceptability by management scenarios. Scale: highly unacceptable (-3) to highly acceptable (3). Scenarios 1 through 8 are defined in table 11.

Paired *t*-tests were used to evaluate significant differences in mean acceptability ratings for all 24 pairwise comparisons of acceptability (Bonferroni correction = 0.05/24, $P < 0.002$) and all were statistically significant. Results also show significant differences in acceptability ratings of the management actions within each of the eight scenarios. Mean acceptability ratings for the "put fire out" action were consistently "acceptable" across all scenarios, with only scenarios 3 and 7 displaying mean ratings below 1.00. For the management action "contain fire," mean acceptability ratings were generally "acceptable" across all scenarios, with mean ratings for this management action being lowest in scenarios 2, 4, and 6 (human-caused fire scenarios). Mean acceptability ratings for the "let fire burn" were consistently and strongly "unacceptable" across all scenarios with mean ratings above -1.00 only in scenarios 3 and 7. In aggregate, these ratings suggest a pattern of response that is dependent upon the scenario factors in a predictable way.

Scenarios 3 and 7 were the only two scenarios where "contain fire" was preferred over "put fire out." Because these were low-impact fires, especially with respect to air quality or property loss, respondents may have felt less urgency to immediately put the fires out. In general, fire origin (human causes), risk to private property, and low ecological impacts (quick recovery and no impact on air quality) influenced the acceptability ratings the most. As might be expected "let fire burn" was the least acceptable management action in all cases.

The common attributes here were quick forest recovery, low risk of private property damage, and low impact on air quality.

Although the underlying factors (e.g., source of fire) influenced the amount of support a given management action received, the "let fire burn" policy action was rated lower in each scenario than the decision to "contain fire" or "put fire out." Acceptance was highest for the "put fire out" decision under scenarios 2, 4, and 6. Only one attribute was common to all three scenarios (human caused). The "let fire burn" action was rated highest under scenarios 3 and 7. The common attributes here were quick forest recovery, low risk of private property damage, and low impact on air quality. These results can aid managers in understanding perceptions of forest visitors regarding wildland fire management and assist in the formation of communication or public involvement plans.

Regression analysis was used to predict acceptability of three general fire management actions. The dependent variables in these analyses were computed indices (let fire burn, contain fire, put fire out) based on the eight scenarios associated with each action. Reliability analysis supported combining the eight scenarios into their respective indices (Cronbach's alphas: let fire burn = 0.89, contain fire = 0.91, put fire out = 0.87). The independent variables in each regression were the five basic belief dimensions and the attitude index (table 13).

Table 13—Prediction of fire management acceptability indices by beliefs and attitudes

	Management action (composite index)					
Belief or attitude	**Put fire out**	**P**	**Contain fire**	**P**	**Let fire burn**	**P**
Biocentrism	-0.038	0.512	-0.023	0.701	0.117	0.064
Anthropocentrism	.002	.968	.117	.054	.117	.001
Freedom	-.148	.006	.025	.654	-.027	.649
Capable/trust	.017	.756	.139	.013	-.032	.591
Responsibility	.136	.012	-.068	.216	-.137	.021
Benefit/harm	-.455	< .001	.372	< .001	.232	<.001
R^2	.248	.196	.086			
F-value	16.533	12.535	5.406			
P	< .001	< .001	< .001			

For the "put fire out" model, the basic belief dimensions of freedom ($P = 0.006$), responsibility ($P = 0.012$), and the benefit/harm attitude ($P < 0.001$) were statistically significant. In the "contain fire" equation, capable/trust ($P = 0.013$) and the benefit/harm attitude ($P < 0.001$) were significant. In the "let fire burn" model, three predictors (anthropocentrism [$P = 0.001$], responsibility [$P = 0.021$], and benefit/harm attitude [$P < 0.001$]) were significant. As the management action moved from put fire out ($R^2 = 0.248$) to contain fire ($R^2 = 0.196$) to let fire burn ($R^2 = 0.086$), the amount of the explained variance declined. In the first two equations ("put fire out" and "contain fire"), 20 to 25 percent of the variation in acceptability responses can be attributed to a combination of belief/attitude variables. For the third one ("let fire burn") less than 9 percent of the variation was explained. These results demonstrate that belief and attitude variables are salient to fire management norms, and that there are different individual patterns of explanatory causes at work for each.

Conclusions

This study presented measures of basic beliefs, attitudes, and norms regarding wildland fire management for the SBNF. The results provided a values-based cognitive profile for this forest and highlighted the role of cognitive concepts in explaining visitor support for management actions. The similarities and differences in explanatory power of the belief and attitude variables across the three management actions were especially important. The results demonstrated that public support is complex and locally situated. Research is needed to extend these results into field applications. For example, the linkage between the beliefs/attitudes and behavioral intent needs to be established in other wildland fire management contexts. Would these results hold if respondents had a particularly strong recent experience with fire, such as loss of property or evacuation? What might be the effect of more positive experiences such as community-based fuel reduction programs, wildland fire communication and education efforts, defensible space training, or other mitigation efforts? Do respondents have other concerns that might affect their norms such as agency trust or economic issues? We encourage further specification of the attitudinal and situational variables to better gauge their effects on the belief/attitude to norm relationship. Further extension of the scenario approach is also warranted, as is trying this approach in other geographic areas with other management actions or situational variables to assess which ones are most salient. Perhaps there are key elements or "triggers" for positive or negative reactions that occur locally at a community or neighborhood level. The factors we used in the scenarios show promise but are by no means an exhaustive list.

Understanding the patterns of acceptability norms for specific actions will lead to greater specificity and tailoring of wildland fire policies and communications.

Overall, these results are useful to managers by pointing out the cognitive context from which visitors' attitudes and behaviors emanate. Knowing more about wildland fire beliefs and attitudes in specific times and places will lead to more effective wildland fire management. Understanding the patterns of acceptability norms for specific actions will lead to greater specificity and tailoring of wildland fire policies and communications.

Metric Equivalents

1 foot = 0.305 meters
1 acre = .405 hectares

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Urban-Proximate Wilderness Visitors[1] Attitudes About Fire Management

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Abstract

Recreationists' views about fire and fire management are essential to effective development of fire management and communication efforts. Yet some evidence suggests that managers' perceptions of recreationists' views about fire might not be correct. To inform this issue, a study of visitors to urban-proximate wildernesses was conducted.

Findings from this study suggest that recreationists on urban-proximate wildernesses were concerned about fire and fire risk and assessed themselves as somewhat knowledgeable about fire and fire risks. They see themselves as sharing values similar to the Forest Service regarding fire management and tend to trust the agency. Similar to prior research findings, our findings are that recreationists expected that they would be bothered by smoke and seeing fire-damaged vegetation.

Although most respondents could accurately answer factual questions about fire-related recreation safety, opportunities for education exist. Routes for education are identified based on sources of outdoor recreation information respondents said they trusted most (including the Internet and family and friends).

General support was found for specific fire management interventions, although expected effectiveness and impact varied somewhat based on the intervention being rated. Support of fire management interventions was accounted for mostly by trust in the Forest Service to take the specific action (including controlled burns, signs at wilderness trailheads, removal of dead or dying trees, and closure of some areas). Communication through the most trusted sources chosen by recreationists may be helpful in building and maintaining trust in these actions.

Keywords: Recreationists and fire management, concern, knowledge, shared values, trust.

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Introduction

Recreationists' opinions and knowledge about natural resource issues continue to play a critical role in effective management. Understanding recreationists' opinions assists with identification of management actions that are acceptable and those that will be met with opposition. Necessary actions that are expected to be opposed may require greater attention in communication efforts designed to address reasons for the action and gaps in knowledge. For example, visitors can be made aware of how their activities put their own safety or the natural resource setting at risk. Increasing awareness can help protect resources and visitors. Yet, little information is available about recreationists' views of fire management. In addition to this dearth of information, some evidence suggests that fire managers, as experts in fire management and its impacts, might not be correct in their assessment of visitor views.

Manning (1999) suggested a gap exists between managers' ideas of visitor perceptions and actual visitor values and attitudes. A recent study found that managers believed there would be little to no impact on visitors' recreational pursuits from visible evidence of wildland fires, trail closures owing to fires, or smoke (Bricker et al. 2005). Yet Chavez and Hendricks (2003) reported that recreationists viewed these same experiences as substantial barriers to their plans for a repeat visit. In addition, Thapa et al. (2004) found that high fire danger or smoke in the area tourists planned to visit might lead some to cancel their trip or change their destination.

Differences in risk perception might further compound the disparity between public and manager perceptions of fire and fire effects. An examination of risk-related decisionmaking suggests that publics and experts assign levels of importance to various aspects of risk differently, resulting in gaps between the two groups in how risk is perceived and beliefs about how it should be addressed (Plough and Krimsky 1987). Although these potentially disparate viewpoints are not explored in this study, they serve as an important basis for the gathering of public perceptions, views, and attitudes.

In addition to the disparity between manager and public perceptions are variations among publics in the acceptance of approaches to fire management. These variations can be explained in part through the level of public trust in the managing agency, which stems from the degree to which values are shared (Cvetkovich and Winter 1998, Siegrist et al. 2000, Winter and Cvetkovich 2003). Evidence suggests that knowledge about fire and concern about fire and fire risk are important in Californians determining ratings about management interventions (Winter 2003).

In this study, an examination of values similarity (degree to which respondents believe the Forest Service shares their values), trust, concern, and knowledge about fire is paired with an inquiry of wilderness visitors to better understand their views on fire and fire management.

Methods

A survey of recreationists entering three federally designated Wilderness areas (San Gorgonio and Cucamonga on the San Bernardino National Forest and Sheep Mountain on the Angeles National Forest) was conducted in summer 2005. The trailheads where visitors were contacted were selected based on moderate to high use levels on weekends to facilitate economy of data collection across the wilderness areas. Two self-administered questionnaires were distributed to each respondent—a short onsite survey and a longer mailback survey. Collection of the onsite survey occurred on both weekdays and weekends between approximately 9 a.m. and 4 p.m. The mailback survey was returned via e-mail or regular post, depending on the stated preference of the respondent. Response rate for the onsite questionnaire was 43.0 percent (368 usable surveys were collected from 855 adults encountered). Of the 177 respondents to the onsite survey who agreed to complete a mailback survey, 103 or 58.2 percent returned a useable survey. About one-third (35.6 percent) agreed to complete a mailback survey and did not. Only 6 percent were undeliverable.

Respondents and Questionnaires

Recreationists who appeared to be age 16 or older and were entering or leaving the wilderness at preselected trailheads were invited to participate in the onsite survey. The onsite survey gathered respondents' sociodemographic information, visitation history, and most trusted information sources about outdoor recreation (using sources similar to those identified by Crano et al. 2006). Respondents who were willing to participate further also provided contact information that went into a distribution list for the longer mailback survey. Among those responding to both the onsite and mailback survey (n = 103), the majority of respondents were male (66.0 percent), middle aged (49.5 percent were between 35 and 54 years of age), with at least some college education (87.4 percent), and had visited this wilderness before (81.6 percent).

The mailback survey asked about:

- Concern about fire ("How concerned are you about fire and the risk of fire on national forest wildernesses?").
- Knowledge of fire and fire risk ("How knowledgeable are you about fire and the risk of fire on national forest wildernesses?").

- Fire and outdoor safety (basic knowledge measures in true/false format derived from visitor information brochures and handouts available from the Forest Service).
- Expected bother or enjoyment of fire-related conditions in the recreation setting.
- Values and goals perceived to be shared between the respondent and the Forest Service regarding fire management ("To what extent do you believe the USDA FS shares your values about fire management?" and "To the extent that you understand them, does the FS have the same goals for fire management as you do?").
- Consistency of Forest Service actions with shared values and justification of inconsistencies ("How often is the following true? The FS makes decisions and takes actions regarding fire management that are consistent with my values, goals, and views." And "How much do you agree or disagree with the following? If or when the FS makes decisions or takes actions regarding fire management that are inconsistent with my values, goals, and views, the reasons for doing so are valid.").
- Trust in the Forest Service's fire management efforts ("To what extent do you trust the FS in their fire management efforts?").
- Approval, efficacy, personal impact, and trust in the agency's use of fire management techniques ("Would you approve of this method of managing fire in wilderness areas?" "Do you think this method would be effective in managing fire in wilderness areas?" "How much impact would this method have on you personally?" "How much do you trust or distrust the Forest Service to [management technique]?").

Results

Trusted Sources of Information

Respondents were asked to select from a predetermined list which source of information for outdoor recreation opportunities they trust the most. A majority (51.5 percent) chose the Internet. Other trusted sources included friends (40.8 percent), newspapers (30.1 percent), family (20.4 percent), magazines (16.5 percent), people from church (7.8 percent), television (6.8 percent), radio (5.8 percent), and people at community organizations (3.9 percent). A few (3.0 percent) wrote in the Forest Service as a trusted source.

Concern and Knowledge About Fire

The level of concern about fire and fire risk was high among a majority of respondents (63.1 percent chose 6, 7, or 8, where 1 = not at all concerned and 8 = very concerned; *M* = 6.1, SD = 2.0, n = 101). Self-assessed knowledge about fire and the risk of fire was rated as moderate or high; 45.6 percent indicated they were knowledgeable (chose a 6, 7, or 8, where 1 = not at all knowledgeable and 8 = very knowledgeable; *M* = 5.2, SD = 1.8, n = 101), about one-third (35.0 percent) chose the middle of the scale (4 or 5), and about one-fifth (17.5 percent) indicated little knowledge (chose 1, 2, or 3).

Values, Goals, and Trust

Respondents tended to believe that the Forest Service shared their values and goals for fire management.

Respondents tended to believe that the Forest Service shared their values and goals for fire management. About half (51.5 percent) rated shared values as a 6, 7, or 8 (where 1 = does not share my values and 8 = shares my values; *M* = 5.9, SD = 2.1, n = 81). More than two-thirds (55.3 percent) rated shared goals as 6, 7, or 8 (where 1 = the FS does not share my goals and 8 = the FS shares my goals; *M* = 6.0, SD = 2.1, n = 81). Respondents also tended to trust the Forest Service overall in its fire management efforts (56.3 percent assigned a rating of 6, 7, or 8, where 1 = completely distrust and 8 = completely trust; *M* = 5.9, SD = 1.9, n = 93).

Consistency of Values and Goals With Action and Justification

More than one-third of the respondents felt that actions taken by the Forest Service were consistent with shared values and goals (43.7 percent chose a 6, 7, or 8, where 1 = never and 8 = always; *M* = 5.5, SD = 1.9, n = 78; 23.3 percent marked "don't know"). They were not always likely to agree that the justification for inconsistent action was valid (35.0 percent chose 6, 7, or 8, where 1 = completely disagree and 8 = completely agree; *M* = 5.2, SD = 1.9, n = 75; 8.7 percent marked "don't know").

Fire and Outdoor Safety

Seven outdoor safety questions related to fire were presented, and respondents indicated which they believed to be true or false (they could also choose "don't know," indicating uncertainty, table 14). The majority (between 63.1 and 100 percent) correctly chose "true" for all questions. However, about one-fourth (between 25.2 and 26.2 percent) were uncertain of the answers to three of the items. These items were, "If I am near a fire I should stay away from trees," "If I am near a fire and it is coming towards me I should avoid going uphill," and "If I smoke while in the outdoors I should be sure there is a 3-foot clearing around me."

Table 14—Knowledge about fire and safety (n = 103)

	True	False	Don't know	Missing
			Percent	
I should never leave a campfire unattended.	100.0	0	0	0
When camping I should avoid building a campfire around overhanging branches, dry grass, and leaves.	99.0	0	1.0	0
When planning a hike I should check on fire conditions of the area where I am headed.	95.1	3.9	0	1.0
When planning a hike I should check with the Forest Service about any special restrictions that may affect my trip.	91.3	3.9	3.9	1.0
If I am near a fire I should stay away from trees.	68.0	4.9	26.2	1.0
If I am near a fire and it is coming towards me I should avoid going uphill.	65.0	6.8	25.2	2.9
If I smoke while in the outdoors I should be sure there is a 3-foot clearing around me.	63.1	6.8	26.2	3.9

Bother or Enjoyment of Fire-Related Conditions in Wilderness

Three potential fire-related conditions were examined to determine expected impact on the respondent (table 15). The majority of respondents were not bothered by areas of forest that had been thinned or cleared to reduce fire danger. Nearly half (48.5 percent) indicated it did not matter and 22.4 percent indicated "some" to "a lot" of enjoyment. On the other hand, more than half indicated they would be bothered "some" or "a lot" by smoke from a nearby fire (60.2 percent) and charred or burned plants and trees (62.1 percent).

Table 15—Ratings of bother or enjoyment of potential fire-related conditions in wilderness (n = 103)

Item	It would bother me a lot	It would bother me some	Doesn't matter	I would enjoy it some	I would enjoy it a lot	Missing
			Percent			
Smoke from a nearby fire	25.2	35.0	34.0	2.9	1.9	1.0
Plants and trees that are charred or burned from a fire	26.2	35.9	34.0	2.9	1.0	0
Areas of forest that have been thinned or cleared to reduce fire danger	8.7	19.4	48.5	14.6	7.8	1.0

Approval, Effectiveness, Personal Impact and Trust of Selected Fire Management Interventions

The majority of respondents approved of controlled burns, believed them to be effective, expected little to no personal impact of the action, and trusted the Forest Service to conduct controlled burns (table 16). Removal of dead or dying trees to reduce fire risk was also approved of by the majority, expected to be effective, and

Table 16—Ratings of approval, effectiveness, perceived impact, and trust of management interventions

Intervention	Scale [a]	Score of 6 to 8	Mean	SD	Number
		Percent			
If the Forest Service were to conduct controlled burns to reduce vegetation and decrease the likelihood of large uncontrolled fires	Approval	71.8	6.1	1.7	102
	Effectiveness	68.9	6.1	1.7	99
	Impact	26.2	3.7	2.0	95
	Trust	60.2	5.7	1.8	100
If the Forest Service were to make certain restrictions on uses of wilderness areas, for example, not allowing campfires	Approval	71.8	6.2	2.0	102
	Effectiveness	52.4	5.7	2.1	97
	Impact	29.1	3.7	2.3	98
	Trust	57.3	5.9	1.7	95
If the Forest Service were to have signs at wilderness trailheads informing forest users of fire risks and how they can help prevent fires	Approval	86.4	7.3	1.2	102
	Effectiveness	45.6	5.4	1.8	101
	Impact	21.3	3.1	2.4	100
	Trust	75.7	6.6	1.6	101
If the Forest Service were to close some areas during fire season, but keep the majority of the areas open to use	Approval	61.2	5.6	2.2	101
	Effectiveness	44.7	5.1	2.2	98
	Impact	48.5	5.1	2.2	96
	Trust	57.3	5.9	2.1	95
If the Forest Service were to remove dead or dying trees to reduce the risk of large, uncontrolled fires	Approval	72.8	6.2	2.0	100
	Effectiveness	63.1	5.9	1.9	101
	Impact	23.3	3.3	2.3	100
	Trust	62.1	5.9	2.1	96

[a] Approval scale was 1 = strongly disapprove, 8 = strongly approve; efficacy scale was 1 = would not be effective, 8 = highly effective; impact scale was 1 = no personal impact, 8 = excess personal impact; trust scale was trust in the Forest Service to implement the technique, where 1 = completely distrust and 8 = completely trust.

expected to have little to no personal impact by the majority of respondents. In addition, the majority tended to trust the agency to implement this action.

The majority of respondents also approved of restrictions on use, rated them as effective, and trusted the Forest Service to manage them. However, more than one-fourth expected "some" to "excessive" personal impact from restrictions (29.1 percent).

The vast majority of respondents approved of signs (86.4 percent chose a 6, 7, or 8) and trusted the Forest Service to manage them (75.7 percent chose a 6, 7, or 8). Of all the suggested interventions, the fewest respondents (21.3 percent) reported expecting "some" to "excessive" personal impact from signs. However, less than half (45.6 percent) believed signs would be effective in reducing fire risk.

A majority of respondents approved of closures of recreation areas (61.2 percent), and most (57.3 percent) trusted the Forest Service to manage fire in this way. However, less than half of the respondents expected closures to be effective and expected "some" to "excessive" personal impact.

Predicting Approval and Effectiveness Ratings of Interventions

The averaged approval and effectiveness rating for each intervention[3] was examined through stepwise linear regression. For each intervention, the regression gauged the ability to predict respondent ratings based on concern about fire and fire risk; knowledge about fire and fire risk; shared values, goals, and trust; consistency and justification; personal impact of the intervention; and specific trust in the Forest Service to manage the intervention. Approval and effectiveness of four of the five interventions was predicted primarily by trust in the agency to manage the intervention.

Those respondents who trusted the agency to conduct controlled burns ($F_{1, 72}$ = 56.230, $p < 0.001$, R^2 adj. = 0.434), manage signs at wilderness trailheads ($F_{1, 73}$ = 17.609, $p < 0.001$, R^2 adj. = 0.185) and remove dead or dying trees ($F_{1, 71}$ = 163.275, $p < 0.001$, R^2 adj. = 0.696) also viewed these interventions to be effective and approved of them (table 17). Approval and effectiveness of closure

[3] Combining ratings of approval and effectiveness was justified by high inter-item correlations in four of the five management interventions (controlled burns r = 0.865; restrictions r = 0.619; signs r = 0.393; closures r = 0.745; removal r =0.796).

Table 17—Stepwise regressions to examine approval/effectiveness ratings of management actions

Approval/effectiveness of intervention	Significant predictors [a]	B	SE	ß	t	Significance
If the Forest Service were to conduct controlled burns to reduce vegetation and decrease the likelihood of large, uncontrolled fires	Trust in FS to conduct controlled burns	0.581	0.077	0.665	7.499	< 0.001
If the Forest Service were to make certain restrictions on uses of wilderness areas, for example, not allowing campfires	Trust in FS to make certain restrictions	.256	.120	.245	2.128	0.037
If the Forest Service were to have signs at wilderness trailheads informing forest users of fire risks and how they can prevent fires	Trust in FS to use signs	.318	.076	.443	4.196	< 0.001
If the Forest Service were to close some areas during fire season, but keep the majority of the areas open to use	Trust in FS to close some areas	.735	.076	.749	9.637	< 0.001
	Concern about fire and the risk of fire	.166	.081	.159	2.040	0.045
If the Forest Service were to remove dead or dying trees to reduce the risk of large, uncontrolled fires	Trust in FS to remove dead or dying trees	.737	.058	.837	12.778	< 0.001

[a] Predictors that went into each stepwise prediction for inclusion/exclusion at the 0.05 level of significance included concern about fire and the risk of fire; knowledge about fire and the risk of fire; average of values, goals, and trust; average of consistency and justification; personal impact of action; and trust in FS for particular action.

of some areas was predicted not only by trust in the Forest Service but also by concern about fire and fire risk ($F_{2, 67} = 51.062$, $p < 0.001$, R^2 adj. = 0.599). For restrictions on use, trust accounted for a significant but marginal amount of the variation in approval and effectiveness ratings ($F_{1, 72} = 4.530$, $p < 0.05$, R^2 adj. = 0.047).

Conclusions

Respondents shared a concern about fire and viewed themselves as somewhat knowledgeable about fire issues on the wilderness. A shared concern and a moderate knowledge level about fire on national forest lands was also reported in a prior study involving California residents (Winter 2003). Similar to the previous study, the current study showed that respondents perceived shared values with the Forest Service regarding fire management and that most of them trusted the agency. This study narrows the focus, specifying trust in the agency to manage five selected management interventions. Furthermore, perceived personal impact was examined in addition to concern, knowledge, and effectiveness/approval ratings. For this group of respondents, trust in the agency to perform each specific intervention (i.e., controlled burns, restrictions on use, signs, closures, removal of dead or dying trees) accounted for the greatest proportion of variance in predicting approval/effectiveness ratings. In most cases, it was the only significant predictor in the regression. This finding demonstrates that trust in the agency to manage the specific intervention is an important factor in understanding perceptions about management alternatives related to fire. However, it does not always serve to account for a satisfactory amount of variance in ratings, so further work is needed to understand ratings of specific interventions, trust in the agency to manage that intervention, and other influences not yet understood.

For this group of respondents, trust in the agency to perform each specific intervention accounted for the greatest proportion of variance in predicting approval/ effectiveness ratings.

When asked to report degree of bother of three fire-related interventions, "smoke from a nearby fire" and "charred or burned vegetation" were viewed as potentially bothersome to respondents. This finding is similar to that reported by Chavez and Hendricks (2003), where smoke was viewed as a barrier to the recreation experience. On the other hand, evidence of thinning and clearing of vegetation to reduce fire risk would bother fewer than a third of our respondents. Perhaps adding the justification (reduction of fire danger) accounted for this inferred acceptance.

Although most respondents were aware of actions they should take in the recreation setting to reduce risk of fire or to increase personal safety during a fire, three items point to an area for increased visitor education: "If I am near a fire I should stay away from trees," "If I am near a fire and it is coming towards me I

should avoid going uphill," and "If I smoke while in the outdoors I should be sure there is a 3-foot clearing around me." Routes used in addition to education efforts onsite might include the trusted sources selected by our respondents, including the Internet, newspapers, magazines, and radio. In addition, encouraging visitors to inform family and friends about these topics and using key community contacts to take advantage of these communication routes would also be fruitful. These same routes might also be used to supply information on selected fire management strategies in order to foster and maintain trust in the specific management actions taken in wilderness settings.

Managers can use these findings as a reminder of the importance of investing in visitor education and communication.

The importance of trust in the agency to manage the specific intervention has been highlighted. Managers can use these findings as a reminder of the importance of investing in visitor education and communication regarding management alternatives, reasons behind selection of them, and expected outcomes. Routes to communicating with publics before they arrive at recreation settings were highlighted, adding further value for managers through application. Using the most trusted sources of information including Internet and family and friends to impart key bits of information will assist in education and communication efforts offsite.

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Recreation and Fire Management in Urban National Forests: A Study of Manager Perspectives

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Abstract

The purpose of this study was to understand U.S. Department of Agriculture Forest Service public land managers' perceptions of fire management and recreational use in urban national forests of the United States. An online survey was used to understand managers' perceptions of (a) the degree to which the presence of recreational activities and experiences are a constraint to fire management, (b) the degree to which fire management and suppression activities influence the quality of a visit to a recreation site, and (c) the relationships between fire management and recreation constraints. In all, 62 district rangers within urban national forests were asked to complete an online survey, and 33 responded (53 percent). The following items were thought to moderately to severely impact the managers' ability to manage fire: increased urban development, budget constraints, accumulation of burnable fuels, effect of smoke on visitors, increased visitation, and the lack of trained personnel. In addition, most managers believed that recreational use of day-use areas, trails, campgrounds, and access roads conflicted moderately or slightly with fire management decisions. Over 70 percent of respondents indicated that mountain bikes on unauthorized trails, vandalism, litter, encroachment from surrounding farmland, unauthorized grazing, and, unauthorized logging did not have an impact on fire management decisions. Generally respondents did not perceive management factors as limiting visitors' pursuit of recreation activities. In addition, most managers identified the occurrence of various management activities (e.g., campground closures from smoke, trail closures owing to wildland fires, fire suppression, etc.) as slightly to not limiting at all.

Keywords: Fire management, fire impacts, outdoor recreation, urban national forests.

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Introduction

Increasingly, public land management agencies entrusted with fire management responsibilities are challenged to address a complex set of variables—in addition to the environmental conditions allowing for a safe and manageable burn (Machlis et al. 2002, McLean 1995). These factors include the size of the burn, location, elevation, landform, soil type, and vegetation including fuel load, climate, wildlife and habitats, policy, funding, air quality, safety of people and property, and access (McLean 1995). The interagency National Fire Plan was established to develop an inclusive strategy to address fire management and the impacts on communities and natural resources (Hendricks et al. 2003). Accordingly, the plan also addressed impacts on outdoor recreation (Chavez and Hendricks 2003).

Forest conditions and evolving land use patterns are creating a potential crisis in fire management (Butry et al. 2002). Evolving land use trends are putting more people in rural settings, increasing the burden on firefighting services and protection (Butry et al. 2002). Haphazard patterns of development result in scattered access, which inevitably increases the cost of fire protection while decreasing its effectiveness (Sampson 1999). In addition to development, the increased number of homes placed adjacent to public lands is on the rise, creating a wildland-urban interface (Wuerthner 2002). Many of these homes are not defensible against fire nor are the owners prepared to deal with the aftermath created by fire. As a result, many homeowners favor fire suppression, which complicates the public land manager's ability to use fire as a tool to maintain or restore damaged ecosystems (Jacobson and Marynowski 1997). People are building homes next to fire-prone ecosystems, which will eventually result in a blaze that will consume their investment (Sampson 1999, Wuerthner 2002). Some communities have taken aggressive actions by developing wildfire mitigation standards (Wuerthner 2002). These policies do not prohibit development but do educate homeowners on how to reduce their risk of damage from fire by clearing trees surrounding their homes and other common sense approaches (Wuerthner 2002).

Increased population growth in wildland-urban interface areas increases challenges for land managers to reduce the risk of wildfires.

People affect public lands not only by direct use, but also by influencing management and land use policies. Therefore, it is important that resource managers recognize the role of people as an integral part of any ecosystem (Jacobson and Marynowski 1997). Increased population growth in wildland-urban interface areas increases challenges for land managers to reduce the risk of wildfires. As catastrophic fires can have a significant economic impact, successful prescribed burning programs that reduce the risk of wildfires can reap great dividends (Sampson 1999, Wuerthner 2002). However, people who

are unaccustomed to the management practice of prescribed burning may oppose the use of fire that results in production of smoke (Butry et al. 2002).

In 1970, legislation mandated that federal agencies incorporate public feedback into management policies and practices (Hendee and Harris 1970). An important step was the realization that effective communication between the public and public land managers was essential in gaining understanding and support for recreation and natural resource management programs (Bright et al. 1993). Because of the legislation and strong increasing public interest, land managers find themselves under constant scrutiny (Bright et al. 1993). Land managers have found it difficult to effectively communicate with the public about resource policies and practices. Public understanding, however, has been identified as a major factor in making prescribed burning management effective (Bright et al. 1993). Fire management officials report that when people understand the dynamics and the need for prescribed burning, they become more accepting (McLean 1995).

The results of several studies have shown that visitor perceptions may differ greatly from how managers perceive visitors' attitudes and preferences (Manning 1999). Typically, managers were oriented to the scientific, educational, and horticultural aspects of the area, whereas visitors focused on the preservation and naturalness of the area. In addition, studies have demonstrated that resource managers were more aware and cognizant of the environmental impacts of recreation in the area being managed than were the visitors (Manning 1999). Hendee and Harris (1970) found that managers overestimated the users' support for facility development and the use of nonintrusive management practices.

Research has indicated that changes in manager attitudes and perceptions are an important aspect in meeting natural resource goals (Manning 1999). Some research, for example, has demonstrated that managers find increased public support through educational programs, which improves visitor behaviors, influences policies, and impacts decisions that affect public lands (Jacobson and Marynowski 1997).

Owing to the complex issues associated with prescribed burns in wildland-urban interface areas, effective communication between land managing agencies and the public needs to be established. To facilitate this communication, land managers must also understand the motivations, attitudes, and preferences of the users. Although we are beginning to understand the visitor's perceptions of prescribed burns and fire management in wildland-urban interface areas (Chavez and Hendricks 2003; Hendricks et al. 2003, 2004), it is also necessary to study managers' perceptions of recreation use and fire management.

The primary purpose of the study was to understand U.S. Forest Service public land managers' perceptions of fire management and recreational use in urban national forests of the United States.

Study Objectives

The primary purpose of the study was to understand U.S. Department of Agriculture Forest Service (USFS) public land managers' perceptions of fire management and recreational use in urban national forests of the United States. Specifically, the objectives were to understand managers' perceptions of:

- The degree to which the presence of recreational activities and experiences are a constraint to fire management.
- The degree to which fire management and suppression activities influence the quality of a visit to a recreation site.
- The relationships between fire management and recreation constraints.

Methods

Researchers conducted an online survey of 62 district rangers located within urban national forests, as identified by the Pacific Southwest Research Station (see app. 1). During spring 2004, each potential participant was sent an introductory letter via e-mail informing them of the study and contact information of those conducting the study. Following Dillman (2007), the second e-mail letter with attached instructions on accessing the online survey was sent 1-week after the introductory letter. For all nonrespondents, a reminder letter was sent via e-mail after 1 more week. The process continued with two more followup letters to nonrespondents requesting their participation in the study.

Of the 62 individuals identified within 15 urban forests, 33 respondents returned completed surveys. These surveys represented 14 of the initial 15 forests identified for this study, for a response of 53 percent.

Online Survey

The study used an online survey. Two of 33 respondents completed the survey off-line and returned it via e-mail because of technical difficulties. The survey addressed several components relevant to fire management and recreation issues:

- Fire management practices within the district.
- Types of recreation opportunities within the district.
- Types of developed areas available.
- Understanding of the purposes of fire management.
- Level of impact of various administrative and visitor occurrences within the forest such as budget constraints, visitors' enjoyment, and management processes.
- Perceptions of conflicts with fire management decisionmaking.

- Perceptions of limitations to visitor pursuit of recreation.
- Frequency of illegal recreation activities and subsequent impacts on fire management decisionmaking.
- Education and public awareness programs.

Results

Characteristics of Respondents

The majority of respondents were male (84 percent), long-time employees of the USFS, and highly educated. Forty-six percent of respondents indicated that they have been employed with the USFS between 25 and 29 years, 19 percent between 20 and 25 years, 14 percent 30 or more years, and 14 percent between 10 and 16 years.

The majority of respondents indicated that their highest level of education was college graduate (70 percent). Twenty-six percent had completed a Masters degree, and 2 percent had some college education. The majority (59 percent) of respondents also indicated their current grade classification was GS-13, 18 percent indicated that their current grade classification was GS-15, and 16 percent indicated a grade classification of GS-14.

Respondents were relatively new to their current position, with 58 percent of respondents in their current position for less than 5 years. Twenty percent had been in their current position for between 5 and 9 years, and 18 percent had been in their current position for between 10 and 16 years. Two percent of the respondents had been in their current position for 20 years. The mean was 5.43 years (SD = 4.5).

Forty percent of respondents indicated that they attended one training session for fire management per year. Twenty percent indicated that they attended two training sessions annually, 30 percent indicated that they attended three training sessions per year for fire management, and 8 percent indicated that they attended more than three training sessions per year.

Fire Management and Operations

The majority of the respondents identified February (60 percent), March (76 percent), and April (62 percent) as the months they conduct prescribed burns. Many conducted prescribed burns in the months of October (56 percent) and November (56 percent). The months least often identified as having prescribed burns were the drier months May (24 percent), June (4 percent), August (2 percent), and September (20 percent).

A majority of respondents identified March (53 percent), February (51 percent), and April (49 percent) as the ideal months for prescribed burning. Many identified ideal prescribed burning in the months of October (47 percent) and January

(40 percent) in their district. The months identified as being the least ideal for prescribed/control burning were July (4 percent), June (7 percent), and August (7 percent).

The majority of the respondents identified that there were between one and four prescribed burns (45 percent) in their district during the past 12 months. Many identified that there were no prescribed burns (25 percent) during the last 12 months. Twenty percent of respondents identified that there were between 5 and 10 prescribed burns, and 12 percent identified more than 10 prescribed burns during the past 12 months within their district.

More than one-third (35 percent) of the respondents identified more than 10 natural fires in their district in the last 12 months. Many identified between 1 and 4 natural fires (28 percent) and between 5 and 10 natural fires (28 percent). A small number of respondents (11 percent) identified that there were no natural fires in their district within the last year.

A majority of respondents (83 percent) identified no controlled burns for ecological reasons in the past year, whereas the remainder (17 percent) identified one to five controlled burns for ecological reasons in the last year within their district. With respect to natural fires out of control within the year, a majority of respondents (75 percent) identified having no fires out of control within the last year. A small proportion (17 percent) identified 1 to 5 fires out of control, and 9 percent identified more than 10 fires out of control within the last 12 months.

The majority of respondents (71 percent) identified the month of August to be dry season. September and July were also considered to be dry season by the majority of the respondents (69 percent and 65 percent, respectively). A small proportion considered December (6 percent), January (6 percent), and February (15 percent) to be dry season.

Visitor Behavior and Fire Management

A majority of respondents identified the months of July (90 percent), June (86 percent), and August (82 percent) as receiving the heaviest visitor use throughout the year. Many received the heaviest visitor use in September (69 percent), May (59 percent), and October (55 percent). The months identified as receiving the lightest visitor use were the winter months of February (10 percent), January, March, November, and December (14 percent each).

The majority of respondents stated that the months that prescribed/controlled burning would have the least impact on users were the cooler months of February (58 percent), January (51 percent), and December (47 percent) (table 18). Ninety-three percent of the respondents indicated that prescribed/controlled burning in

Table 18—Months identified as when prescribed/ control burning would have the least and most impact on users

Month	Least impact		Most impact	
	Number	*Percent*	*Number*	*Percent*
January	23	51	22	49
February	26	58	19	42
March	18	40	27	60
April	15	33	30	67
May	9	20	36	80
June	3	7	42	93
July	4	9	41	91
August	4	9	41	91
September	3	7	42	93
October	6	13	39	87
November	15	33	30	67
December	21	47	24	53

the month of June would have the greatest effect on users (table 18), as well as in the months of September (93 percent), July (91 percent), and August (91 percent).

All the respondents stated that they had developed recreation areas within their districts. Ninety-two percent described managed areas as "overnight with fees," and 88 percent managed areas having "day use with fees." A large proportion of respondents (78 percent) managed the area(s) of "day use with no fees" as well as "overnight with no fees" (66 percent). Twenty-four percent of respondents stated that they used "backcountry permits" in their districts.

A majority of respondents identified camping (97 percent), picnicking (97 percent), walking trails (92 percent), hunting and recreational shooting (89 percent), hiking (84 percent), marine/wildlife viewing (84 percent), fishing (84 percent), sightseeing (84 percent), driving corridors (84 percent), mountain biking (84 percent), and photography (81 percent) as occurring in their district. Additional activities were identified as winter nonmotorized (38 percent), winter motorized (14 percent), air-based (8 percent), races (5 percent), mountaineering/climbing (5 percent), spelunking or caving (5 percent), and gold panning (3 percent).

The most common primary activities identified by each respondent were camping (37 percent), driving corridors (18 percent), and sightseeing (13 percent) (table 19). The most common secondary activities identified were camping (24 percent), hiking (21 percent), walking trails (11 percent), and sightseeing (11 percent). The most common tertiary activities were using all-terrain vehicles/motorbikes (16 percent), hiking (14 percent), and wildlife viewing (11 percent).

Table 19—Primary, secondary, and tertiary recreational activities identified by respondents

Activity	Primary recreation activity		Secondary recreation activity		Tertiary recreation activity	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Camping	14	37	9	24	3	8
Driving corridors	7	18	3	8	3	8
Sightseeing	5	13	4	11	3	8
Hiking	2	5	8	21	5	14
Picnicking	2	5	2	5	3	8
Hunting & recreational shooting	2	5	1	3	1	3
ATV/motorbikes	2	5	3	8	6	16
Backpacking	1	3	1	3	2	5
Naturalist led programs	1	3	0	0	2	5
Motorized boating	1	3	1	3	1	3
Mountain biking	1	3	0	0	0	0
Wildlife and marine viewing	0	0	0	0	4	11
Walking trails	0	0	4	11	2	5
Fishing	0	0	1	3	0	0
Swimming and wading	0	0	1	3	0	0
Horseback riding	0	0	0	0	2	5

ATV = all=terrain vehicle.

Impacts to Fire Management

Respondents were asked to indicate the importance of a number of statements in incorporating prescribed burning as a management tool. Seventy percent of the respondents identified that prescribed burning was very important for forest health and ecosystem maintenance (table 20), 65 percent identified that prescribed burning was very important for the control of burnable fuel accumulation, 54 percent identified that prescribed burning was very important for the protection of surrounding urban development, 31 percent identified that prescribed burning was very important for the rejuvenation of native plants, and 27 percent identified that prescribed burning was very important for the creation of fire lines and for native animal habitat creation.

Of those identifying impact, 43 percent identified the increase in urban development nearby as having a severe impact on their ability to manage fire, 35 percent identified budget constraints, and 30 percent identified the accumulation of burnable fuels.

Of those identifying impact, 43 percent identified the increase in urban development nearby as having a severe impact on their ability to manage fire, 35 percent identified budget constraints, and 30 percent identified the accumulation of burnable fuels (table 21). Forty-six percent of respondents identified that smoke's effect on visitors had moderate impact on their ability to manage fire, along with increased visitation, and the lack of trained personnel (43 percent). Fifty-four percent of respondents identified public opposition to fire management

Table 20—Importance of prescribed burning for various purposes

	Very important		Somewhat important		Important		No at all important	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Forest health—ecosystem maintenance	70	26	22	8	5	2	0	0
Control burnable fuel accumulation	65	24	19	7	8	3	5	2
Protect surrounding urban development	54	20	19	7	14	5	11	4
Rejuvenate native plants	31	1	27	10	27	10	14	5
Create fire lines	27	10	19	7	32	12	19	7
Native animal habitat creation	27	0	46	17	24	9	0	0
Control insects	8	3	35	13	27	10	27	10
Enhance aesthetics	8	3	22	8	27	10	41	15
Control recreation fire risks	8	3	24	9	35	13	30	11
Hands-on firefighting experiences	3	1	22	8	35	13	38	14

Table 21—Impact on respondents' ability to manage fire

	Severe impact		Moderate impact		Slight impact		No impact	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Forest health—ecosystem maintenance	70	26	22	8	5	2	0	0
Increased urban development nearby	16	43	13	35	6	16	1	3
Budget constraints	13	35	13	35	9	24	1	3
Accumulation of burnable fuels	11	30	13	35	8	22	4	11
Process bureaucracy	10	27	13	35	11	30	2	5
Federal policy restrictions	8	22	12	32	12	32	4	11
Smoke's effect on visitors	7	19	17	46	8	22	4	11
Increased visitation	6	16	16	43	11	30	3	8
Unauthorized recreation activities	3	8	5	14	16	43	12	32
Natural fires	1	3	11	30	14	38	8	22
Public opposition to fire management practices	1	3	13	35	20	54	2	5
Lack of trained personnel	1	3	16	43	8	22	11	30
Lack of regional support	1	3	9	24	8	22	18	49
Logging practices within forest	0	0	3	8	7	19	26	70

practices having only slight impact on their ability to manage fire, with a majority of respondents identifying logging practices within the forest having no impact on their ability to manage fire (70 percent). Interestingly, respondents were somewhat evenly spread on their perception of bureaucracy influencing their ability to manage fire at approximately one-third each, severely (27 percent), moderately (35 percent), and slightly (30 percent).

Fire Management and Visitor Conflict

Respondents were asked if they perceived recreational user conflict with fire management decisions in or near day use areas, trails, campgrounds, and access roads.

The majority of respondents perceived moderate to slight conflict with day use areas (59 percent), trails (73 percent), campgrounds (54 percent), and access roads (73 percent).

In addition, respondents were asked to identify whether they perceived limitations to visitors' pursuit of recreation in their district. Of those identifying severe limitations, 19 percent identified out-of-control fire from arson, 17 percent identified out-of-control fire from a campfire, and 11 percent identified out-of-control fire from prescribed origins (table 22). Of those identifying moderate limitations, 44 percent identified the prohibitions of fire in campgrounds and fire pits, 39 percent identified prohibitions of fire in backcountry, and 31 percent identified visible smoke as moderately limiting visitors' pursuit of recreation within their district.

Table 22—Respondents' perceived limitations to visitors' pursuit of recreation

	Severe limit		Moderate limit		Slight limit		Does not limit	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Fire out of control from arson	7	19	9	25	14	39	6	17
Fire out of control from a campfire	6	17	9	25	17	47	4	11
Fire out of control from prescribed origins	4	11	8	22	5	14	19	53
Campground closures from smoke	3	8	2	6	12	33	19	53
Prohibitions of fire in backcountry	3	8	14	39	14	39	5	14
Trail closures due to wildland fires	3	8	3	8	21	58	9	25
Decreased air quality	3	8	3	8	23	64	7	19
Fire out of control from natural causes	3	8	8	22	16	44	9	25
Fire out of control from logging operations	3	8	1	3	7	19	25	69
Prohibitions of fire in campgrounds and fire pits	2	6	16	44	15	42	2	6
Traffic delays due to fire management practices	2	6	3	8	17	47	14	39
Prohibition of fireworks	2	6	4	11	13	36	17	47
Visible evidence of wildland fires	1	3	3	8	14	39	18	50
Fire suppression	1	3	7	19	21	58	7	19
Decreased scenic beauty from smoke	0	0	8	22	14	39	14	39
Visible smoke	0	0	11	31	14	39	11	31
Prohibition of smoking tobacco	0	0	3	8	16	44	17	47
Prescribed ecologically beneficial fire	0	0	3	8	18	50	14	39
Natural ecologically beneficial fire	0	0	1	3	13	36	22	61
Fire from logging brush	0	0	0	0	5	14	31	86
Fire from residential brush burning	0	0	2	6	9	25	25	69

More than half of respondents perceived visitors' pursuit of recreation within their district as only slightly limited by trail closures owing to wildland fires (58 percent), fire suppression (58 percent), decreased air quality (64 percent), and prescribed ecologically beneficial fire (50 percent). More than half the respondents perceived that visitors' pursuit of recreation within their district was not limited by campground closures from smoke (53 percent), visible evidence of wildland fires (50 percent), natural ecologically beneficial fire (61 percent), fire from logging brush (86 percent), out-of-control fire from prescribed origins (53 percent), and out-of-control fire from logging operations (69 percent).

More than half of respondents perceived visitors' pursuit of recreation within their district as only slightly limited by trail closures owing to wildland fires, fire suppression, decreased air quality, and prescribed ecologically beneficial fire.

Respondents were asked to indicate how frequently certain incidents occurred in the district(s) they manage. Half of all respondents identified that both litter and increased urban development always occurred in their district(s), 28 percent indicated that vandalism always occurred, and 25 percent indicated that both campfires in nondesignated areas and visitors wandering off designated trails always occurred within the district(s). Half of the respondents indicated that visitors wandering off designated trails frequently occurred in the district(s) they manage, 47 percent identified that vandalism and campfires in nondesignated areas frequently occurred within their district(s), and 39 percent identified that the illegal use of firearms occurred frequently within their district(s).

More than half of respondents identified that public opposition to fire management (81 percent), illegal use of fireworks (75 percent), visible smoke from a prescribed fire (67 percent), illegal bonfires (61 percent), wildland fires (56 percent), unauthorized grazing (58 percent), mountain bikes on unauthorized trails (51 percent), unauthorized hunting (50 percent), and unauthorized logging (50 percent) seldom occurred within the district(s) they managed. Some respondents indicated that encroachment from surrounding farmlands and unauthorized logging (42 percent), development of industry (36 percent), and unauthorized grazing (28 percent) never occurred within the district(s) they managed.

To understand to what degree certain incidents affect decisions concerning fire management in the district(s) they manage, respondents were asked a series of questions concerning known effects that have been identified in the literature. Forty-two percent of respondents indicated that increased urban development severely impacted their fire management decisions, and 33 percent indicated that wildland fires did so (table 23). Many respondents identified that campfires in nondesignated areas (25 percent), visible smoke from a prescribed fire (25 percent), and increased urban development (22 percent) moderately impacted their fire management decisions.

Public opposition to fire management was considered as having a slight impact on fire management decisions by 67 percent of respondents (table 23). Illegal

Table 23—The degree to which incidents affect decisions concerning fire management

	Severe impact		Moderate impact		Slight impact		No impact	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Increased urban development	15	42	8	22	7	19	5	14
Wildland fires	12	33	6	17	14	39	3	8
Visible smoke from a prescribed fire	3	8	9	25	14	39	9	25
Litter	2	6	1	3	3	8	29	81
Illegal use of fireworks	2	6	7	19	13	36	13	36
Mountain bikes on unauthorized trails	1	3	2	6	5	14	27	75
Vandalism	1	3	1	3	6	17	26	72
Campfires in nondesignated areas	1	3	9	25	14	39	11	31
Illegal use of firearms	1	3	1	3	8	22	25	69
Visitors wandering off designated trails	1	3	2	6	9	25	23	64
Illegal bonfires	1	3	6	17	16	44	12	33
Use of flammable fuels by visitors	1	3	3	8	12	36	18	50
Unauthorized grazing	1	3	1	3	5	14	28	78
Development of industry	1	3	1	3	8	22	25	69
Encroachment from surrounding farmlands	0	0	1	3	2	6	31	86
Unauthorized hunting	0	0	1	3	10	28	24	67
Unauthorized logging	0	0	1	3	2	6	31	86
Public opposition to fire management	0	0	4	11	24	67	7	19

bonfires (44 percent), wildland fires (39 percent), campfires in nondesignated areas (39 percent), and visible smoke from a prescribed fire (39 percent) were considered as having a slight impact on fire management decisions by many of the respondents. However, the majority, (more than 70 percent of respondents) indicated that the following incidents did not have an impact on fire management decisions:

- Unauthorized logging (86 percent)
- Encroachment from surrounding farmlands (86 percent)
- Litter (81 percent)
- Unauthorized grazing (78 percent)
- Mountain bikes on unauthorized trails (75 percent)
- Vandalism (72 percent)

Education and Public Awareness

All respondents stated that they conduct educational/public awareness programs to inform people about forest fire management issues in their district. Programs ranged from public awareness programs for fire management issues to news releases about current conditions to school programs and campfire programs (see app. 2). Twenty-five percent of respondents indicated that they conducted educational/public awareness programs one to six times per year. An additional

25 percent stated that they conduct the programs more than 20 times per year. Twenty-two percent identified conducting the programs 7 to 12 times per year, and 11 percent stated that they conduct the programs 13 to 20 times per year. Thirty percent of respondents indicated that the educational/public awareness programs were targeted toward children and young adults, and 22 percent targeted homeowners near or adjacent to the forest; 17 percent had no specific target group at all.

Conclusions

Most of the managers surveyed perceived urban development and the occurrence of wildland fires as severely impacting their fire management decisions. Others felt that some recreational-related events such as campfires in nondesignated areas and the impact of visible smoke from a prescribed fire moderately impacted their decisions concerning fire management. The majority of respondents felt that illegal or unauthorized recreational activities such as mountain bikes on unauthorized trails and vandalism had little or no impact on their decisions to manage fire.

When managers were asked about conflicts related to recreation and fire management, overall they perceived moderate to slight conflicts with day-use areas, trails, campgrounds, and access roads. Managers in essence were impeded to some degree within and surrounding these types of areas when it came to fire management.

Overall, prescribed and controlled burns are taking place outside of the heaviest recreational use months for the forests represented within this study. Managers did suggest that the prescribed/controlled burns would least impact recreation during December, January, and February. Most considered February, March, and April as ideal for prescribed/controlled burns, yet generally avoided months with heaviest visitor use (i.e., summer).

Overall, managers perceive that most of the actions they take with regard to fire do not limit or only slightly limit visitors' pursuit of recreational opportunities.

When asked about visitors' limitations in their pursuit of recreation, more than half of the respondents suggested that visitors were not limited by campground closures from smoke, visible evidence of wildland fires, natural ecologically beneficial fires, fires from logging brush, and out-of-control fire from logging operations. Overall, managers perceive that most of the actions they take with regard to fire do not limit or only slightly limit visitors' pursuit of recreational opportunities within the forest. Certainly whether or not visitors' perceptions are similar is an area for continued study and comparison.

Findings also suggest that managers surveyed did not perceive their actions related to fire management as limiting visitor's pursuit of recreational experiences. Most of the managers perceived their actions such as campground closures from smoke, visible evidence of wildland fires, trail closures owing to wildland fires,

fire suppression activities, traffic delays owing to fire management, prohibition of fireworks and tobacco use, decreased air quality, prescribed and naturally occurring ecologically beneficial fires, fires from logging brush, and fires from logging operations as not at all or slightly limiting visitors' pursuit of recreation.

Recommendations

Based on the results of this study, it is recommended that further research focus on areas where perceived conflict is greatest. Perhaps an understanding of visitors' knowledge of fire management in these areas can reduce potential conflict and resolve perceived limitations of managing for fire in these specific areas.

Further understanding of the effectiveness of both the messages and information relayed and the target audience is necessary to manage fire in recreation areas and near urban environments, as well as find a common ground between management perceptions of managing for fire in recreation areas, and visitors' understanding of fire management strategies and operations.

It is interesting to note, that while managers did not perceive fire management as limiting to recreational opportunities, they did perceive recreation areas limiting their ability to manage fire. A comparison of visitor's and manager's perception would assist in determining a common understanding of the impacts on both managers and visitors.

This study was conducted online. Although this was an effective way to minimize costs, we felt that it may have had some impact on the response rate. We also recommend conducting focus groups with managers to understand all of the complexities and operational environment in managing for fire in the forests.

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Appendix 1—Urban National Forests and Grasslands

Angeles National Forest
Arapaho and Roosevelt National Forests
Chattahoochee National Forest
Cimarron Comanche National Grasslands
Cleveland National Forest
Gifford Pinchot National Forest
Los Padres National Forest
Mt. Baker-Snoqualmie National Forest
Mt. Hood National Forest
Pike, San Isabel National Forests
San Bernardino National Forest
Tonto National Forest
Uinta National Forest
Wasatch-Cache National Forest
White Mountain National Forest

Appendix 2—Educational/Awareness Programs

Types of educational/public awareness programs described by respondents:

- Public awareness programs for fire management issues
- Press releases about current conditions and use restrictions
- Fire prevention programs at schools, public meetings for proposed vegetation/fuels management projects, forest plan revision public notice and comment
- Three public information persons in fire management. Considerable media involvement
- Various school programs are presented each year, partnership with (local) Fire Safety Awareness Center, (local) Youth Forest, news releases, working with communities on Fire Wise program, Fire Works program, campfire programs in (local) Canyon
- News releases and personal contact
- Numerous fire prevention and education programs as well as fairs and parades
- Programs with the local school district
- Approximately 15 to 20 prevention contacts each year. Classrooms, fairs, special events, etc.
- Mostly on the subject of defensible space and children's programs

- Go to classrooms to talk about the Forest Service in general
- Newspaper articles, radio talk shows, school talks, service club talks
- In conjunction with our fuels management program we have educational sessions, usually with the state foresters and other land managers, about the role of fire in this ecosystem and steps we are taking to return the forest to a healthier condition.
- Presentations at local primary and secondary schools. Meetings with county commissions, etc.
- Smokey programs, part of hunter education programs, newspaper articles
- Prevention programs conducted with state foresters (all year, but especially during fire prevention week)
- Personal public contacts with adjacent landowners or others who may be affected by prescribed burn activities
- District personnel do talks with school children and also interpretive talks at developed campgrounds
- Public community meetings, fire prevention programs, Fire Safe/FireWise communities, external scoping
- FireWise homeowners meetings, Wildland/Urban Interface meetings, implementation of the Good Neighbor Agreement
- Smokey Bear programs in schools. News release about prescribed burning.
- Prevention technicians conduct numerous programs.
- Smoky Bear and a fire engine at numerous activities
- FireWise programs are held in schools and community groups by the district's fire management officer or the fire prevention officer
- We have fire prevention people who visit with a variety of groups to get out different fire messages
- We do conservation education programs with some stressing the need to be careful with fire, but we also show that not every fire is devastating. We teach that fire has a long-term beneficial role in the environment by restoring eco-systems.
- In addition to fire prevention programs and messages that are handled by district fire prevention technician, we use every opportunity possible to inform our public about fire awareness such as local parades, state fair, county fairs, and radio stations.
- Only when we are having fires. This ranger district received over 100 inches of precipitation annually. Fire starts are usually only a few each year and the fire-return interval for large fires is 200 to 300 years.

- Primary (local) media outlet. Public outreach, work with local papers, fire prevention technician, naturalist programs, knowledgeable personnel, multiple tours
- Press releases and news articles
- Smoky Bear programs to local schools. Talks at Rotary and Chamber of Commerce. Displays at ranger stations
- District and forest-level conservation education effort to provide public information regarding fire and fuels management as well as insect and disease problem
- Work with community Fire Safe councils and property owners associations to inform, educate public on hazardous fuels program. Our volunteer association conducts evening campfire programs that introduce folks to fire and fuels management issues and programs.
- Smokey Bear programs for kids. Presentations by ranger or staff at meetings of community groups, environmental groups, etc. Participation in local Fire Safe Council.
- At fairs, schools, special events and other community gatherings. We staff a standard display with information, offer books for sale, meet, greet, and answer questions
- Through public involvement in the NEPA process for prescribed burns; with school groups through the (local) Youth Forest; through the printed media; open houses; annual fire management meetings with cooperators; Living With Fire programs.

Perceived Risk, Attitude, Knowledge, and Reactionary Behaviors Toward Wildfires Among Florida Tourists

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Abstract

Wildfires can pose a serious threat to tourism, a main economic engine in virtually all states. A representative sample of 771 tourists (66 percent response rate) in Florida counties that had a recent wildfire and received fire suppression funds completed a mailback survey that assessed their perception of risk, knowledge of wildfire, attitudes toward wildfire, and behavioral changes. In general, wildfires have had a minimal impact on past Florida trips, and most tourists felt little risk for future trips. Although 61 percent agreed that wildfires were a factor in evaluating travel destinations, 70 percent also reported that they would not let wildfires keep them from traveling to their Florida destination. Florida tourists differed in their knowledge about, and understanding of, the role of fire in Florida's landscape. Two-thirds of the tourists knew about prescribed fires, but only 25 percent thought natural areas in Florida should be burned periodically. Other questions revealed that three situations would result in substantial alteration (cancel or change destinations) to their trip by about half of the tourists: the presence of high fire danger conditions, reported health problems from smoke and ash, and fire spreading to nearby vacation regions. Further discussion of the implications of these issues and other findings for land management decisions, tourism promotion, and communications in general is noted.

Keywords: Wildland fire, tourism, perceived risk.

Introduction

Florida is an immensely popular national and international tourist destination as evidenced by 83.6 million visitors (78 percent domestic), and it generated $62 billion in overall tourism spending (tourism/recreation taxable sales) during 2005. There are an abundance of attractions and destinations for various types of outdoor recreation activities enjoyed by visitors and residents in Florida (Holland et al. 2002). Over 7.4 million visitors were recorded in 2006 among the four largest

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National Park Service areas located in Florida (Everglades and Big Cypress National Parks, Canaveral and Gulf Islands National Seashores). Based on the National Visitor Use Monitoring Program (USDA FS 2007), the national forests in Florida (Apalachicola, Osceola, and Ocala) accounted for 2.7 million visits. Furthermore, according to the Florida State Park Service, 17.3 million annual visits were reported among the 159 public use sites and natural areas that encompass 723,000 acres statewide. The State Park system is one of the largest in the country and popular among residents and tourists, who report high levels of satisfaction (Holdnak and Holland 2001).

Wildfire is an annual threat. In recent years, notably in 1998, 2001, and 2007, severe drought conditions have led to wildfires that affected large parts of Florida. Commonly, smoke conditions have closed interstate highways and promoted air quality alerts (Drummond 1998, Woodman 1998). Thus, fires have become an increasingly important issue for recreational and leisure travelers as well as destination promoters and managers. The mandatory evacuations, smoke conditions, road closures, and negative media all contribute to the economic repercussions in tourist-dependent communities. Butry et al. (2001) estimated that the 1998 fires resulted in gross losses of $61 million to the lodging industry and $77.2 million in other business sectors. This was especially true in Orange, Volusia, St. John's, and Brevard Counties, which are located in the Orlando and central Florida east coast regions. In 2007, wildfires created similar disruptions and closures, especially in counties along the eastern Georgia-Florida border, where the fires originating in the Okefenokee National Wildlife Refuge area resulted in closed highways and many home evacuations in both Georgia and Florida.

Thus, fires have become an increasingly important issue for recreational and leisure travelers as well as destination promoters and managers.

The impact of fire on tourism and subsequent economic losses has also become more evident in virtually all the Western States over the last two decades (Hardy-Short and Short 1995, Wilkinson 2000), including the highly publicized Yellowstone National Park fires of 1988 (Schullery 1989). Some tourism operators have endured park closures, and other businesses have failed owing to the loss of tourism (Earnest 2002, Hogan 2002, Kim 2002, Morton et al. 2003, Wilkinson 2000).

Clearly, wildfires have substantial economic consequences for host communities. In addition, wildfire season coincides with the peak tourist season in many communities especially for nature-based operators and suppliers that depend on tourist business during the summer months. The severity of wildfire impacts are further exacerbated by the media, which often deters potential visitors, thus resulting in loss of income to the original destination (Smith 2007, Wilkinson 2000). However, destination and state promotion agencies have been aggressive in

portraying positive spins via press releases and the Internet/World Wide Web to counteract dramatic negative burn images to make tourists aware that their states are still open for business (Amdahl 2001, Hogan 2002, Yancy 2002).

Nevertheless, safety remains an important aspect of travel destination choice for most tourists because risk perception influences the tourist decisionmaking process (Pizam et al. 1997). Although there is scant literature on the effects of wildfires on travel behavior, research parallels can be drawn from related studies about tourists' perceptions of risk and safety (Drabek 2001, Floyd et al. 2004, Pizam et al. 1997, Sonmez and Graefe 1998, Thapa 2004). A recurring theme in travel risk research is that safety concerns and tendencies to visit a destination are related to an individual's perceived risk associated with traveling to and being at that destination (Floyd et al. 2004, Sonmez 1998).

Wildfires have received considerable attention in the media, leading to a level of genuine concern among the public (Cohn et al. 2006). Fire-related research has predominantly employed samples from residential communities and visitors to national parks and wilderness areas located in the Western States (Daniel et al. 2007, Field and Jensen 2005, Rodriguez-Mendez et al. 2003). There is a paucity of research from other regions of the country, notably Florida where wildland fire plays a pivotal role in the lives of residents and potentially millions of tourists. The few studies (Butry et al. 2002, Jacobson et al. 2001, Loomis et al. 2001, Nelson et al. 2005, Winter et al. 2002) that have been conducted in Florida, have all polled resident samples. Florida, however, depends on tourism. Recreational and leisure travelers, and the businesses that rely on and support their needs are also severely affected. Although the displacement of tourists and the negative economic impact to the tourism industry owing to wildfires has been widely reported in the popular media, empirical studies about tourist perceptions and behaviors related to wildfire are rare. The purpose of this study was to examine perceived risks, attitudes, knowledge, and reactionary behaviors toward wildfires among Florida tourists.

Methods

Data collection was conducted by a national consulting firm that specializes in tourism research. The sample was demographically stratified to match U.S. census data. For this study, potential respondents were drawn from a sample of nonresident overnight leisure travelers that had visited Florida in the past year. The sample was screened to target tourists that had visited destinations/counties that had been affected by wildfires. In 2001, fires were reported for all counties except one (Hamilton County) (n = 66), hence a more stringent criterion was used. Counties that had large wildfires and received state or federal fire suppression funds were

chosen to represent the strata of counties substantially affected by wildfires in 2001. Twenty-six counties were selected based on the criterion.

A four-page mailback questionnaire was sent to 1,160 households on March 2002 targeting a specific head of the household. After followup reminders, 771 surveys were returned for a response rate of 66.5 percent. The survey instrument consisted of various questions that related to wildfires, tourist behaviors, and demographics. First, a respondent's travel pattern was assessed, such as reason for visit, destination visited, frequency of visit, mode of transportation, length of stay, group size and composition, type of accommodation, activity participation, quality of visit experience, intention to revisit, season of visit, and source of information. Second, a respondent's perceived levels of risk associated with wildfires were examined. Multiple-item questions were created relating to perceptions about risks that might affect future decisions to travel to Florida and other states, travel safety, destination decisions, and the impact of wildfires and about reactionary travel behaviors if faced with various hypothetical wildfire-related situations. Additional questions assessed respondents' knowledge of and attitudes toward fire.

Results

Demographic Profile

In general, about 88 percent of the households comprised at least two adults, and 30 percent had four or more members. Fifty percent of the households had incomes between $50,000 and $99,999. The majority were predominantly Caucasians (82 percent), with African Americans (10 percent) and Hispanics (8 percent) composing the next largest ethnic groups (an additional effort was made to contact African-American and Hispanic travelers from the general pool of potential respondents). Seventy-seven percent of the respondents were women. Overall, 76 percent were married, and 14 percent were single who had never married. Also, 82 percent were homeowners. The majority of respondents (82 percent) represented 41 states, with the largest segments from New York (11 percent), Pennsylvania (8 percent), Georgia (6 percent), Texas (5 percent), and Maryland (5 percent).

Travel Patterns

Based on the survey response, 40 of Florida's 67 counties (59 percent) were visited during the respondents' most recent trip to Florida. Also, 19 of the 26 counties (58 percent) that had fires and received fire suppression funds were visited during the most recent Florida trip. Orange-Osceola Counties (Orlando area) were visited by 28 percent of the respondents; Dade-Broward Counties (Miami-Fort Lauderdale

area) represented 16 percent, and Hillsborough-Pinellas Counties (Tampa-St. Petersburg area) accounted for 9 percent. Orlando (24 percent) was reported to be the main destination followed by Tampa-St. Petersburg (9 percent).

Respondents were frequent visitors to Florida as 90 percent indicated that they were repeat visitors with 38 percent reporting they had visited two to four times in the past 5 years. Fifty-five percent of the respondents spent 7 days or more during their most recent trip to Florida, and 30 percent indicated 4 to 6 days. Visitation occurred during all 12 months of the year, with 48 percent visiting December through March. The primary mode of transportation for most visitors was commercial airlines (57 percent) followed by personal vehicles (34 percent); 31 percent stayed with friends or relatives and 31 percent in a hotel or motel. Respondents' travel groups were generally small with two to five persons (73 percent); 63 percent of the travel parties included only adults over 18 years of age. Seventy-three percent of the travel groups were family, 13 percent were friend-based groups, and 9 percent represented a combination of friends and family.

Shopping (55 percent) was the most popular activity, followed by visiting the beach (53 percent), visiting friends and relatives (46 percent), and visiting theme parks (30 percent). In addition, visiting friends or relatives (36 percent), visiting theme parks (20 percent) and visiting the beach (11 percent) were noted to be the primary reason for visiting Florida. During respondents' most recent trip, 44 percent reported visiting some form of designated outdoor park, forest, or refuge. Local parks (20 percent) or state parks (13 percent) were visited more often than federal lands (11 percent). Overall, respondents (88 percent) expressed a high level of satisfaction with respect to their most recent visit to Florida. Weather and traffic problems were the primary contributing factors for those respondents that noted their trip quality was negatively affected. Forest fires or smoke were noted by less than 1 percent of the respondents. Also 61 percent reported that it was very likely that they would return to Florida for a vacation in the next 2 years, followed by 19 percent indicating that they would be somewhat likely to return. Only 4 percent noted that they were very unlikely to return. Finally, previous visit knowledge, word of mouth from others, and the Internet were among the top sources of information that respondents indicated they used to plan trips to Florida.

Weather and traffic problems were the primary contributing factors for those respondents that noted their trip quality was negatively affected. Forest fires or smoke were noted by less than 1 percent of the respondents.

Perceived Level of Risk

Respondents were asked to rate the level of risk they perceived to be associated with a variety of potential events that could affect their future decisions about traveling to Florida. Some respondents perceived risk for natural weather disasters (34 percent) (note: the survey occurred before the severe 2004 Florida hurricane

season), terrorism (20 percent) (respondents were surveyed after the September 11, 2001, terrorism events), financial risks owing to cancellations (18 percent), crime risks (16 percent), health risks (16 percent), and out-of-control wildfires (11 percent). Thirty-one percent of respondents perceived that there was absolutely no risk of out-of-control wildfires in Florida, and an additional 58 percent perceived the risk to be very low or low.

Similarly, respondents' perceptions of risk from wildfires, as either "unsafe" or "very unsafe," for travel to other states were California, 25 percent; Colorado, Florida, and Montana, 6 percent each; Texas and Wyoming, 5 percent each; Arizona, New Mexico, and Washington, 4 percent each; Georgia and Tennessee, 2 percent each. Conversely, the proportions of respondents rating a selected state as either "very safe" or "safe" in terms of threats from wildfires were Tennessee, 54 percent; Georgia, 53 percent; Florida, 51 percent; Colorado, 49 percent; Arizona, Texas, and Washington 48 percent each; New Mexico, 46 percent; and California, 33 percent. In addition, respondents were asked if they would avoid any states because of the probability of wildfires. Ninety-seven percent said they would not avoid a state, and 3.5 percent said they would, with 65 percent of those listing California as the avoided destination.

Travel Perceptions

Respondents were asked 12 statements on a 5-point Likert scale response format (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) about travel safety, destination decisions and wildfires. Six items are reviewed in this paper. About 23 percent agreed (combined responses of strongly agree and agree) that safety is not an important consideration in choosing between destinations in Florida. About 61 percent of the respondents agreed that wildfires are not a factor in evaluating travel destinations, whereas 14 percent disagreed (combined responses of strongly disagree and disagree). A majority (80 percent) of the respondents agreed that wildfires in Florida had never influenced their decision to travel. Similarly, about 70 percent agreed that they will not let wildfires keep them from traveling to their final Florida destination. Only 2 percent agreed that negative news about wildfires would discourage them from traveling to Florida, and 82 percent disagreed. Also, 8 percent reported that they would only travel to Florida if they believed it was safe from wildfires, but 60 percent noted that they would travel either way (table 24).

Table 24—Travel perceptions

Statement[a]	Rating					
	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	Mean[b]
			Percent			
Safety is not an important consideration when I'm evaluating different destinations in Florida to travel to.	8.6	33.1	35.5	16.0	6.8	2.79
When I'm evaluating destinations to travel, wildfires are not a factor.	4.2	9.4	25.5	39.4	21.5	3.65
Wildfires in Florida have never influenced my decision to travel there.	4.1	4.5	11.3	37.2	42.8	4.10
I would not let wildfires keep me from traveling to my final destination in Florida.	2.6	6.5	20.6	40.6	29.6	3.88
I'd like to travel to Florida but negative news about wildfires discourages me.	40.4	41.8	15.8	1.2	0.8	1.80
I will only travel to Florida if I believe it is safe from wildfires.	27.3	32.3	32.1	7.2	1.2	2.23

[a] Please indicate your level of agreement or disagreement with each of the statements.

[b] Means calculated based on 5-point scale, strongly disagree (1) to strongly agree (5).

Reactionary Behaviors

Respondents were asked to report how they would change their travel behavior if faced with potentially disruptive wildfire-related situations such as road closures, smoke, etc. Of the 14 situations, all but 4 induced a range of responses from more than two-thirds of the respondents. For most situations, at least 30 percent responded that they would cancel their trip or change either their destination or activity. Four situations generated widespread agreement that they would not change their travel plans if (1) there were multiple fires in the state but not at their vacation region, (2) there were prescribed fires by natural resource managers outside their vacation region, (3) fire were present in an adjacent region but not in their vacation region, and (4) an unattractive burned landscape from a past fire were present at their destination, with only 15 percent saying they would cancel their trip or change destination in this last instance (table 25).

For most situations, at least 30 percent responded that they would cancel their trip or change either their destination or activity.

Three situations resulted in at least 10 percent of the respondents stating they would cancel their trip, and between 32 percent and 43 percent additionally changing their destinations, resulting in a range of 44 to 55 percent who would make substantial alterations to their trip. The situations were (1) the presence of high fire danger conditions, (2) reported health problems from smoke and ash, and (3) spread of fire to nearby vacation region.

Table 25—Reactionary behaviors to specific wildfire-related situations

Fire-related situations[a]	Rating				
	Cancel trip	Change destination	Change activity	No change	Don't know
			Percent		
Two-hour traffic back-ups due to fire detours	3.4	30.4	31.1	22.6	12.5
Automobile accidents due to smoke	4.9	36.3	23.9	22.3	12.7
Threat of road closures	4.8	37.2	25.1	21.2	11.8
Smell of burned wood in the air	1.9	13.5	16.2	60.7	7.7
Health problems from smoke and ash reported	13.3	32.1	24.6	16.1	13.9
High fire danger conditions	15.3	32.9	15.9	24.7	11.1
Smoke from current fire in destination area	8.7	38.3	22.1	17.5	13.4
Unattractive burned landscape from past fire at destination	1.5	13.7	8.4	69.3	7.2
Fire in an adjacent region but not in your vacation region	2.6	8.3	5.7	73.0	10.4
Multiple fires in the state but not in your vacation region	2.0	3.2	1.6	86.3	7.0
Prescribed controlled fires in your vacation region	4.1	21.3	13.3	44.6	16.4
Prescribed fires by natural resource managers outside your vacation region	1.5	4.5	3.3	81.1	9.6
Negative news from the media about wildfires in Florida	3.8	7.5	3.8	64.8	20.1

[a] If you were planning a trip to Florida and the following situations came to your attention, what would you do: cancel your trip; change your destination; go to your destination but change your intended activity (refers to what you were planning to do, i.e., going to the beach, hiking, or visiting theme parks, etc,); or no change in your activity or destination?

Three scenarios resulted in at least 33 percent of the respondents stating they would change the destination they were planning to travel to on their trip: (1) smoke from a current fire was in the destination area, (2) the threat of road closures, and (3) automobile accidents owing to smoke.

Attitudes Toward Fire

Respondents were asked to rate their level of agreement with five attitudinal statements about fire (5-point Likert scale response format of 1 = strongly disagree to 5 = strongly agree) that were originally used by Jacobson et al. (2001). Based on the responses, higher proportions of agreement were evident for statements such as, "stricter regulations should be placed on burning" (51 percent agreeing and only 4 percent disagreeing) and "people who live near natural areas may have to tolerate some smoke from fires" (51 percent agreeing and 9 percent disagreeing; table 26). Although levels of disagreement were still only approximately 20 percent, the

Table 26—Attitudes toward fire

Statement[a]	Rating						
	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	Don't know	Mean[b]
	Percent						
Fire is beneficial to Florida's native plants.	6.1	11.9	34.3	28.4	6.3	13.1	3.2
The natural areas in Florida should be burned periodically.	5.8	14.9	41.2	22.4	2.5	13.2	3.01
Protecting air quality is more important. than burning natural areas	2.0	13.9	40.8	27.5	8.6	7.2	3.29
People who live near natural areas may have to tolerate some smoke from fires.	1.8	7.4	31.0	45.3	6.0	8.4	3.51
Stricter regulations should be placed on burning.	1.3	3.2	34.0	33.3	18.1	10.1	3.71

[a] Please indicate your level of agreement or disagreement with each of the statements.

[b] Means calculated based on 5-point scale, strongly disagree (1) to strongly agree (5).

higher percentages of disagreement were associated with the statements "natural areas in Florida should be burned periodically" (21 percent disagreeing and 25 percent agreeing), and "fire is beneficial to Florida's native plants" (18 percent disagreeing and 35 percent agreeing). Finally, the statement "protecting air quality is more important than burning natural areas" received agreement ratings from 36 percent and disagreement from 16 percent of the respondents. A high level of neither agreement nor disagreement (41 percent) was related to two issues, "natural areas in Florida should be burned periodically," and "protecting air quality is more important than burning natural areas."

Fire Knowledge

Finally, respondents were asked six statements related to fire knowledge based on three response categories (correct, incorrect, and don't know) originally used by Jacobson et al. (2001). About 40 to 50 percent of the respondents seemed to be unsure about fire knowledge, while generally another 40 to 50 percent seemed to be well informed (table 27). Between 1 and 9 percent (depending on the issue), had false understandings about fire impacts. Thus, among those who thought they knew the correct answer, most did know the correct response. The statement with the highest correct level was "prescribed fire is when land managers purposefully set a fire" which 67 percent knew to be true and only 1 percent thought was false. The highest proportion of uncertainty (49 percent) existed for the statement "Florida's natural areas will remain the same without fire" while 43 percent knew this to be false. The statement "human carelessness causes more fires in Florida than lightning" was believed to be true by 54 percent and false by 6 percent; "fire helps

Table 27—Fire knowledge

Statement (correct answer)	Respondent belief that statement is true or false		
	False	True	Don't know
		Percent	
Natural areas that are burned every few years are useless as wildlife habitat in Florida (F).	42.6	9.9	47.5
Fire helps to renew forests in Florida (T).	7.2	52.1	40.7
Periodic fire is a natural process in Florida (T).	4.9	58.0	37.1
Human carelessness causes more fires in Florida than lightning (T).	5.9	53.6	40.5
Florida's natural areas will remain the same without fire (F).	42.6	8.7	48.6
Prescribed fire is when land managers purposefully set a fire (T).	1.3	67.2	31.4

to renew forests in Florida" was believed to be true by 52 percent and false by 7 percent; and "periodic fire is a natural process in Florida" was believed to be true by 58 percent, false by 5 percent, and 37 percent did not know.

Discussion and Conclusion

The respondents in this study were familiar with Florida. Overall, the demographics and travel and behavioral patterns were consistent with previous studies conducted by Visit Florida, which is the official quasi-public tourism agency responsible for promoting Florida. At the actual travel experience level, it appears the effects of wildfire had minimal impacts on past Florida trips for a few people and no impact on the vast majority. Only 4 percent of the respondents rated their most recent trip to Florida below average, and less than 1 percent mentioned fire or smoke as negatively affecting their trip. Most of the respondents would have been assessing a 2001 trip to Florida. Compared to previous years, in 2001, Florida had a relatively lower number of wildfires, although approximately 3.6 million acres burned. When asked about potential risks they could face on future trips, almost 90 percent see no cause for concern: 31 percent of respondents perceived that there was absolutely no risk of out-of-control wildfires in Florida, and 58 percent perceived the risk to be very low or low. A majority (80 percent) of the respondents noted that wildfires in Florida had not influenced their decision to travel, while 9 percent said it had an influence in their decision to travel. Compared with other states, only 6 percent of the respondents said they thought Florida was unsafe for travel owing to wildfires, the same percentage as Colorado and Montana. In contrast, California was rated unsafe by 25 percent. About 51 percent said they thought Florida was

Eighty percent of the respondents noted that wildfires in Florida had not influenced their decision to travel.

either safe or very safe with little or no danger from wildfires. Only 4 percent said that they would avoid a destination because of the probability of wildfire. Of those who would avoid an area, two-thirds of those mentioned California, and only one person mentioned Florida. Overall, 80 to 90 percent of the respondents were either neutral or undeterred by the possibility or presence of fires at Florida destinations, and less than 20 percent were concerned or would take evasive action because of wildfires.

A final set of issues were presented to the Florida tourists, to better understand how they might change their behavior under different conditions that could exist as a result of wildfires in Florida. For four of the issues, 69 to 86 percent of the respondents said they would not change their travel plans if (1) there were multiple fires in the state but not at their vacation region, (2) there were prescribed fires by natural resource managers outside their vacation region, (3) fire were present in an adjacent region but not in their vacation region, or (4) an unattractive burned landscape from a past fire were present at their destination. Three statements seem to indicate that these experienced Florida tourists understand that Florida is a geographically large state and that fires can exist in the state that do not affect the area they will be in. Most do not seem to be detracted by burned-over landscapes, perhaps because the majority will stay in urban settings or visit beach areas, which would not be expected to have large burned areas.

Florida tourists differed in their beliefs and perceptions about the role of fire in Florida's landscape. About one-third of the tourists took a neutral stance on most of the items, but 51 percent thought stricter regulations should be placed on burning and that people who live near natural areas may have to tolerate some smoke from fires. Two-thirds of the tourists knew that prescribed fire is when land managers purposefully set a fire. Less than 10 percent were incorrect in their responses, and generally, about half of the tourists were unsure about fire-related issues, which may mask a higher proportion of incorrect responses. It is apparent that fire education needs to be promoted so that tourists are informed during their vacation as well as upon returning to their home states.

In conclusion, the data suggest that wildfires have not significantly affected many Florida tourists in the recent past, nor is Florida perceived by the vast majority of tourists to be a state where the threat of wildfires is a major concern. Although more than half of the respondents said that wildfires were a factor they would consider in choosing destinations, 70 percent said they would not let wildfires keep them from traveling to their final Florida destinations. This still leaves 30 percent who might, and 30 percent represents potentially 20 million tourists. There seems to be a substantial number (about half) who do not appear to understand the

role of fire in Florida's natural environment, and efforts to reduce this unawareness or misunderstanding could raise the tolerance and understanding of some visitors to be more accepting of controlled burns. Also, there seems to be general acceptance of the possibility and acceptability of wildfires that are not close to a destination they are traveling to, so emphasizing the distance away from wildfires might be a good strategy to reduce cancellations or destination substitution. The negative impact of burned-over areas from past fires seems minimal, and with Florida's long growing season and heavy vegetation in many natural areas, the visibility of burn scars is limited in time.

In severe situations where fire is present, smoke and ash are causing reported health problems, or officials are declaring a high fire danger situation, visitor reactions are more disruptive to local businesses. This means that as many as 50 percent would cancel their trip or change their destination. This is consistent with what would be expected in any highly disruptive situation such as a hurricane or major snowstorm. About 35 percent are changed destinations, so from a statewide perspective, there is opportunity to still capture most of these in other parts of the state, and there should be a procedure or marketing efforts to offer alternatives. From the local destination perspective, it would be a substantial economic loss to lose 50 percent of the expected tourists, even for short periods. Perhaps this could be better managed by having a fire awareness link on state and county tourism promotion Web sites or interpretation programs at state parks or visitor centers.

The impacts are projected to be almost as bad for destinations disrupted by high levels of smoke, automobile accidents because of smoke, or road closures, with about 40 percent of the tourists saying they would either change destinations (36 to 38 percent) or cancel their trip (5 to 9 percent). Similarly, efforts to offer alternatives in the region or state should allow the recapture of most of this business. However, an intriguing finding is that, although a controlled burn might be justified in the eyes of some, many people would respond negatively after the highly publicized incidents of controlled burns getting out of control in New Mexico and Colorado in recent years. Perhaps better education with respect to ecological benefits and fuel reduction issues might minimize negative reactions and attitudes.

Perhaps better education with respect to ecological benefits and fuel reduction issues might minimize negative reactions and attitudes.

This study is one of the few studies of tourists' perceived risk, attitude, knowledge, and reactionary behaviors to encountering wildfires or smoke on their trip, and as far as we are aware, the first to study Florida tourists. Overall, the results were based on a representative sample of domestic tourists that had visited Florida. This exploratory study offers an initial assessment of the relationship between wildfires and domestic tourists that had visited Florida. Future research has an opportunity to build upon this study on a broader geographical scale to provide a

better understanding of tourist behaviors and help in marketing efforts during crisis situations. We recommend that similar studies be conducted in other states where tourists perceive higher fire risk, such as California, Colorado, Montana, Texas, Wyoming, Arizona, New Mexico, and Washington. Other related research would help to both expand and further understanding of tourists' perception of risk and reactionary behaviors toward wildfires.

Metric Equivalents

1 acre = 0.405 hectares.

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Communication Research

More Than Just a Message: Risk Communication and the Decisionmaking Process

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Abstract

The risk communication process can be characterized as any purposeful exchange of information about potential hazards between interested parties. Traditional examinations of risk communication have focused on the **content** of risk messages and the process for distributing these messages. Significantly less attention has been devoted to the intent of risk communication. Specifically, what are risk communicators trying to achieve? For most, the **intent of** the communication is to either inform or influence risk management decisions. This article explores this often-neglected aspect of the risk communication process.

Keywords: Risk communication, decisionmaking, heuristics, affect, representativeness, framing.

Introduction[4]

Risk communication—as a field of study and practice—emerged in the mid-1980s. One of the first published definitions of risk communication characterized the process as any purposeful exchange of information about health or environmental risks between interested parties. These exchanges typically involve the transfer of information about risks—termed risk messages—from experts to nonexperts. The content of these risk messages generally takes the form of (1) facts or hypotheses about the level of risk that exists within a system, (2) the significance or meaning of the risk relative to other issues of concern, or (3) decisions, actions, or policies that may be undertaken to manage or control it (National Research Council 1989).

Consistent with this early definition, two main motivations for engaging in a risk communication effort are the need or desire to (1) inform or be informed

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and (2) facilitate the involvement of the interested and affected parties in risk management (decisionmaking) processes. The first motivation often arises out of government requirements to inform the public about certain hazards and risks (e.g., the U.S. Administrative Procedures Act, the Canadian and American Freedom of Information Acts, the U.S. National Environmental Policy Act, provisions under the U.S. Superfund Amendments, and others). The second motivation reflects a desire or requirement to move from traditional bureaucratic decisionmaking models that are expert and agency driven to models that include experts and nonexperts, public and government groups, and affected lay stakeholders.

Components of Risk Communication

Because of its linkages with both information processing and decisionmaking, risk communication can be thought of as having both prescriptive and descriptive components (Arvai 2000). The prescriptive component of risk communication is broad and can be viewed as the process that takes place prior to and during the setting of policy agendas or the making and implementation of risk-policy decisions. Prescriptive risk communication involves developing a shared understanding of the risks and benefits associated with a particular activity through the transfer of risk messages between individuals, institutions, and communities (Slovic 1993). This shared understanding is developed through an interactive process of information exchange between stakeholders such that the different points of view regarding impending or ongoing decisionmaking processes (e.g., representation, objectives, alternatives, tradeoffs, etc.) become better understood by all of the parties involved. In other words, the objective of the prescriptive risk communication is to help foster the meaningful involvement of the interested and potentially affected parties in good decisionmaking processes regarding risks (i.e., to more broadly inform decisions and policymaking).

Descriptive risk communication usually follows decisionmaking and is aimed at a broad audience to provide supporting information and increase awareness about risk decisions, guidelines, and policies that have already been made. Both components of risk communication are important; however, the prescriptive aspects of the process have traditionally been the focus of most risk communication research. Therefore, in this paper, the general term of risk communication will refer to the prescriptive component of risk communication.

The focus on prescriptive risk communication is primarily due to two factors; first, it is difficult to have a credible descriptive risk communication effort when the prescriptive aspect of the process is questionable or has been perceived by the wider public as being a failure. The fallout from Hurricane Katrina is a clear example.

The risk communication process that took place prior to and during Hurricane Katrina was haphazard and had little involvement of stakeholders from at-risk communities (Rivers 2006). As a result of this breakdown in prescriptive risk communication, risk managers and communicators on the Gulf Coast, particularly in New Orleans, are still struggling to establish an adequate descriptive risk communication agenda. Second, there is also significant focus placed on the prescriptive aspects of the risk communication process because several important dimensions of risk communication largely take place during this component (Arvai 2007). These three main components are the focus of the following discussion.

Prescriptive Risk Communication

The broad prescriptive component of risk communication can be broken into several interrelated dimensions: process, content, and intent. The process aspect (i.e., how to actually execute and design a successful risk communication program), has been explored with considerable detail in the literature (cf. Chess and Salomone 1992, Chess et al. 1995, Covello and Allen 1992, Fischhoff 1995, Johnson and Fisher 1989, Slovic 1986). As the field has progressed, much of this information has been condensed into several useful and detailed discourses presented in the form of risk communication "handbooks" (e.g., Covello et al. 1988, Lundgren and McMakin 1998). Studies of the procedural aspects of risk communication have also led to the development of methods by which critical evaluations of specific risk communication programs can be carried out (see Arvai 2000, Jardine and Hrudey 1997, Powell and Leiss 1997).

Content refers to the information that a risk communication program presents. Several recent research programs have focused on developing methods by which the makeup of risk messages can best be established. Perhaps the best and most widely applied example of this work can be found in the field of mental models research (e.g., see Bostrom et al. 1992, 1994; Kovacs et al. 2001; Maharik and Fischhoff 1993; Morgan et al. 2002; Zaksek and Arvai 2004), which presents one way to identify information needs of the target population. This literature suggests using indepth interviews and followup surveys to identify the major gaps in knowledge among key stakeholders about the specific topic of communication.

Significantly less attention has been devoted to the third element of prescriptive risk communication, the intent of the communication. Specifically, what are communicators trying to achieve? For most, the intent of the communication is to either inform or influence risk management decisions (Arvai et al. 2001, Cvetkovich et al. 1989, Gregory 1989). Unfortunately, there has been very little attention paid to individual decisionmaking as a crucial aspect of risk

communication. Many practitioners of risk communication assume that risk decisions will be based mainly on the quality of the risk information that is presented to decisionmakers. As a result, designers of risk communication processes have relied heavily on risk analysts to provide them with detailed information regarding the nature of many risks, rather than with information about the receivers of their message.

Although having high-quality risk information on hand during decisionmaking is clearly important, behavioral decision research (e.g., see Kahneman et al. 1982, Kahneman and Tversky 2000, Plous 1993, Simon 1956, Slovic et al. 1977, Tversky and Kahneman 1981) has demonstrated that low-quality decisions occur not just because there is a lack of good information on which to base a choice. The quality of risk management choices is also strongly linked to two important aspects of the risk communication process—judgmental heuristics and biases. Judgmental heuristics include the extent to which a risk communication process leads people, either intentionally or unintentionally, to rely upon a series of simple rules of thumb to make quick decisions. Although heuristics often lead to quick and reasonable decisions in simple contexts, in more complex situations they often lead to the appearance of systematic biases during the decisionmaking process (Tversky and Kahneman 1974). The other aspect, decision biases, comes as the result of the high degree of malleability in judgment that characterizes many decisions and is linked directly to how decision-supporting information is presented (Slovic 1995). These two aspects of risk communication are the focus of the remainder of this article.

Risk Communication, Judgmental Heuristics, and Biases in Individual Decisionmaking

It is widely accepted, particularly in the field of economics, that "rational" decisionmakers will pursue decisions that are always in their best interests. For an example, consider the case of decisionmaking in the face of a potential natural disaster. Events such as these are uncertain both in terms of the probability of occurrence and the magnitude of the potential consequences. A rational decisionmaker would therefore choose a course of action only after assessing the probability of the event's occurrence and the benefits and costs associated with all of the possible options that may be undertaken. This process involves a series of complex calculations that proponents of rational models of decisionmaking assume people can make, and make well (Gilovich et al. 2002).

An alternative viewpoint is that people either abandon or do not fully consider rational decisionmaking approaches owing to task complexity and limited processing ability. People's ability to be rational is bounded (Simon 1956) such that they

make many decisions after evaluating a set of considerations and alternatives that may be nonrepresentative. Moreover, people tend to rely heavily upon a series of intuitive heuristic principles that reduce complex judgment tasks to simpler operations (Kahneman et al. 1982, Mellers et al. 1998). Relying on heuristics has the advantage of reducing the amount of time and level of effort required to make decisions without—for many routine decisions—compromising the quality of the choice. The application of these heuristics can yield close approximations to decisions expected by rational models for choices that require low levels of effort or accuracy. However, as the context of the choice becomes more complex or unfamiliar, a heavy reliance upon these heuristics frequently leads to decisions that are biased (Plous 1993). Unfortunately, most risk communication efforts address complex issues, and the use of decision heuristics to make decisions in these contexts often leads to poor decisions.

Representativeness—

A heuristic often relied on is that of representativeness, which diminishes individuals' use of probabilities in making judgments. Representativeness refers to the phenomenon of people judging probabilities by the degree to which one stimulus, A, is representative of another, B (Tversky and Kahneman 1974). This heuristic is directly responsible for a commonly held, erroneous belief that probability is self-correcting, also known as the gambler's fallacy (Tversky and Kahneman 1971). The gambler's fallacy suggests that individuals expect a run of good luck or bad luck to eventually come to an end, based on previous results and not salient base rates (base rates refer to the prevalence or probability of an incident, trait, or particular characteristic occurring in a population). To illustrate this fallacy consider the following series of five coin tosses (heads = H, tails = T): HHHH. Most people would place a higher probability on the fifth toss being a T; however, the probability of this toss resulting in H or T is still 0.5. The coin, B, (if unbiased) is not affected by the prior outcomes, A.

Similar to the coin in the aforementioned example, many natural phenomena that pose a hazard to human health and property, such as hurricanes, earthquakes, and to some extent wildfire, are not affected by previous track records. In other words, the occurrence of a serious hurricane in a particular area of the country one year does not mean that an equally or possibly more devastating hurricane will not appear in the same region the next year. This is an important concept for risk communicators to share with relevant stakeholder groups; however, it directly contradicts the more intuitive yet faulty logic of the gambler's fallacy. The fact is that, in terms of natural disasters, lightning can and often does strike twice in the same place.

Many natural phenomena that pose a hazard to human health and property, such as hurricanes, earthquakes, and to some extent wildfire, are not affected by previous track records.

Affect—

A second potentially biasing heuristic involves an overreliance on affect during judgments and decisionmaking. Affect is defined as an instinctive feeling-state that people experience such as arousal (e.g., happiness, sadness) or the level of valence people associate with a stimulus (e.g., goodness, badness). An individual's affective reactions are the result of neuropsychological development and environmental factors (e.g., what an individual has experienced in the past). These affective feelings have been demonstrated to help guide many risk judgments and decisions (Damasio 1994, Lerner and Keltner 2001, Loewenstein et al. 2001) often by working in conjunction with more analytic modes of judgment, such as those applied during cost/benefit calculations. However, studies have also shown that strong affective reactions can overwhelm more thoughtful (cognitive) analyses of problems (Finucane et al. 2000, Slovic 2000).

The affective responses that many risks incite are strongly negative and, therefore, can wreak havoc with decisionmaking by overwhelming the cognitive analysis of the problem. This is especially true for traditionally stigmatized risks such as nuclear power, terrorism, and genetically modified organisms. Perhaps the best recent example of this is the massive government resource expenditures on and, until recently, widespread public support for the affectively charged "war on terror" as compared to relatively small expenditures on less salient but often higher risk problems such as road safety and environmental degradation (Slovic 2004, Sunstein 2003).

Similarly, Wilson and Arvai (2006) showed that the affective characteristics of the problem context or situation as opposed to the attributes associated with an alternative or alternatives can also lead people to ignore data from risk assessments and make their decisions based on affect alone. Furthermore, attaching strong affective cues (i.e., the development of an emotional attachment) to the problem context can override improvements in decisionmaking performance that might otherwise result from prescriptive efforts aimed at improving individual decisionmaking.

Beyond manipulating people's affective responses such that they largely ignore quantitative risk information, risk communications may also target people's affective impressions such that certain hazards—which otherwise do not elicit a strong emotional reaction, but still pose a significant risk—are made more salient. In Canada, for example, warning labels on packages of cigarettes have been made larger and more prominent, appearing on the front of the package above the manufacturer's label. They also depict full-color and very graphic images that depict the risks associated with smoking such as lung disease, emphysema, or erectile dysfunction. These affect-rich warnings have proven very successful at targeting

people's emotional responses, thus heightening risk perceptions among smokers and nonsmokers when compared with more traditional, text-based warning labels (Hammond et al. 2003).

Framing effects—

As the previous discussion has demonstrated, choices in complex or unfamiliar contexts are driven by cues that are present in the information possessed by the decisionmaker. In the case of affect and representativeness, the cues were either preexisting in the mind of the individual based on past experiences or automatically accessed to provide supplemental information to a difficult decision. Beyond these passive impacts, it is also possible to deliberately frame risk information such that certain values or habits that a decisionmaker brings to bear on a decision problem are engaged (Kahneman and Tversky 2000).

Strategic framing is commonplace in risk communication because of the effectiveness and the relative ease with which it can be implemented. The recent rebranding of petroleum firm BP is an excellent example of such reframing. No longer labeled British Petroleum, BP is now Beyond Petroleum, which invokes a much more positive and innovative connotation for the company than that with which it was previously associated. Framing can also be used to highlight specific aspects of a decision depending on the stance that the communicator is taking. Consider the case of the Yucca Mountain Nuclear Waste Repository. Depending upon which risk communication program is reviewed, the decision to build the repository has been framed as a policy that will either involve significant losses in terms of environmental quality, cultural and tribal traditions, and prestige for the state of Nevada, or significant gains in terms of national and homeland security, an increase in state funding, and the creation of a new and safer interstate transportation system.

Individual Decision-Focused Risk Communication

Although each of these three examples of how risk communication may influence risk management decisions are different in that they activate different types of judgmental strategies, they all demonstrate that for many relatively unfamiliar decision contexts, people's preferences are not preexisting. Instead, communication processes that force people to think about risks or to articulate their values or choices provide cues to people that help them to construct their preferences on the spot (Arvai et al. 2006, Payne et al. 1993, Slovic 1995). Therefore, a risk communicator should not be viewed as a kind of "cognitive archaeologist" that uses information and deliberative processes to uncover attitudes and preferences about risks that already exist in the mind of the recipient. Instead, risk communicators should act

as "judgmental architects" understanding that the information that people receive, along with how this information is presented, influences the way in which individual decisions, and therefore behavioral responses, are constructed.

This constructionist view of preferences explains why—and how—risk communication efforts can be manipulated to inform certain kinds of preferences (specificity) and by extension, motivate specific behaviors. However, risk communication can also be viewed as a tutorial that builds understanding of a problem and works to overcome common biases as it informs a choice.

Some Prescriptive Thoughts

Thus far, this article has hinted at just a few of the issues that need to be addressed to foster more defensible, higher quality risk management decisions. Risk managers/communicators need to recognize, and account for, the potentially biased judgmental heuristics, such as representativeness, that people typically use when faced with complex choices. Effective decisionmakers will balance affect-based responses to stimuli alongside technical analyses of information and push aside relatively simple conceptions of information or alternatives that may lead to very specific responses (i.e., framing effects). Each of these strategies can be implemented through the inclusion of decision-structuring tools in risk communication efforts. These tools help people to more fully define the decision and risk-specific objectives, identify or understand the available risk management options that are sensitive to these objectives, and then address the often difficult tradeoffs that choosing among options entails (Clemen 1996, Hammond et al. 1999, Kleindorfer et al. 1993).

Alongside the careful presentation of risk information, a critical activity in a decision-focused risk communication effort is the engagement of recipients in a process of thinking carefully about their objectives as they relate to risk management. One aspect of this process should focus people on their values (e.g., the importance of sustainability), which can be expressed, for the purpose of decisionmaking, as objectives (e.g., taking actions that promote sustainability). A second aspect should help people distinguish between means and ends objectives, which helps to facilitate clear thinking about risk management options (Keeney 1992).

A decision-focused risk communication effort goes a step further by omitting endorsements of a single course of action and prompting people to think about the difference between means and ends objectives.

For example, many risk communication efforts that deal with climate change focus on transportation and fuel efficiency. A decision-focused risk communication effort goes a step further by omitting endorsements of a single course of action and prompting people to think about the difference between means and ends objectives. Promoting fuel efficiency in one's personal vehicle is a means objective, the ends objectives are to decrease greenhouse gas emissions and reduce the speed at which the climate is changing. Using a diverse array of risk messages—in the form of

fact sheets, advertising spots on television and radio—that don't endorse a specific alternative but instead encourage people to think about these ends objectives helps to avoid anchoring on a single course of action (another decision heuristic). Instead of focusing on purchasing a fuel-efficient vehicle as the only solution, this approach opens the door to other possible risk management alternatives (e.g., using public transportation in place of a personal vehicle). A risk communication effort of this type does not preclude one from eventually choosing a more fuel-efficient vehicle. It can, however, help people to realize that a single option is not a panacea and that a combination of strategies may be combined to achieve a desired effect.

Beyond widening the range of possible risk management options that might be considered by a decisionmaker, the process of helping people to identify and clarify objectives, and the alternatives that stem from them, serves two other important functions. First, a thorough exploration of management objectives helps to legitimize the much-needed balance between what are traditionally technical concerns (such as reducing the likelihood of exposure, restoring or maintaining environmental health) and those that are affective or values-oriented in nature (such as reducing feelings of dread, building trust and confidence in agencies). Second, exploring a comprehensive set of objectives at the front end of a decisionmaking process is an important first step toward avoiding many of the problems associated with potentially biased heuristics. In the case of framing, for example, the consideration of a wider range of decision-relevant objectives can help decisionmakers realize that identified problems cannot be solved by focusing only on one of its dimensions. Likewise, helping an individual or group to more fully understand what it is that they might want to achieve with a risk management decision places the focus squarely on objectives and weakens the appeal of representative explanations.

Naturally, engaging people in a process of identifying what matters to them and what they want to achieve with a decision raises another question: How can people choose which risk management option is "best"? In some cases, such as when only a single objective matters, a single best risk management option can clearly be identified. More often than not, however, many conflicting objectives are in play (e.g., minimizing costs, maximizing safety, etc.) and decisionmakers must realize the inevitability of tradeoffs: the need to give up something valued in order to gain something that is also valued but for different reasons.

Risk communication efforts can help, in some cases simply by reminding people of the need to address tradeoffs.

Tradeoffs are inherently difficult for most decisionmakers because of the psychological conflict that they evoke (Gregory et al. 2001). Risk communication efforts can help, in some cases simply by reminding people of the need to address tradeoffs. In other more complex cases, risk communication efforts can be used to provide guidance or specific tools to decisionmakers about how to carry out more

formal tradeoff analyses. Doing so frequently involves providing participants in risk communication efforts with computer-based tradeoff aids, which may be sent to people on compact disk or made available on the Internet. In their most basic form, these tradeoff tools involve the ranking and weighting of objectives as they relate to expectations about how different risk management options are expected to perform. Several useful methods for helping people to reconcile complex tradeoffs exist, such as swing-weighting and even-swap techniques (see Arvai and Gregory 2003, Clemen 1996, Hammond et al. 1999, Keeney 1992). In the end, risk communication efforts should emphasize the need for clear tradeoffs in the context of balancing conflicting objectives, because investing more on any one risk management option often means investing less in others.

Conclusion

The majority of this article has focused on the intent dimension, specifically the decisionmaking process and decision heuristics, of the risk communication process. However, it is critical that risk managers and communicators not lose sight of the importance of both components of the process, prescriptive and descriptive, as well as each element of the prescriptive component (content, process, and intent). A credible risk communication effort requires that all aspects of the process have been attended to and thoroughly integrated. For the sake of clarity, and to explore the more neglected aspects of the risk communication process, we have divided risk communication into separate parts, which may seem to suggest that it is a linear process. However, in reality, risk communication efforts are highly organic undertakings with each aspect of the process influencing others. In other words, risk communication is replete with internal feedback loops.

For example, when crafting a prescriptive risk communication program, it would seem natural that after the initial design of the program has been created the content aspect of the program would be developed next, which would culminate in a decision being made by a targeted stakeholder (intent). However, it may be necessary to alter or augment the content presented by a risk communication effort during the decisionmaking process in order to develop a more complete set of objectives or to perform a tradeoff between two management options. To further extend this example, the design of the risk communication effort may be inadvertently leading decisionmakers to rely on decision heuristics that are not optimal for solving the problem, resulting in the need to redesign the effort to avoid these heuristics or to use other more appropriate heuristics.

In the end, it is impossible to consistently design risk communication programs that will be seen as successful by all relevant stakeholders. However, it is possible

to create credible programs that integrate the various aspects of the risk communication process. Such an approach is more likely to result in well-thought-out and defensible decisionmaking.

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Quick-Response Research of Communication Between Agencies and Interface Communities During Wildland Fire

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Abstract

An interagency research team studied fire communications during different stages of two wildfires, one relatively small fire of short duration and one large fire of long duration. This "quick-response" research showed that prefire communication planning was particularly effective for smaller fire events and parts of such planning proved invaluable for the large fire event as well. Information seeking by the affected public relied on locally convenient sources during the small fire. The information being sought included the precise location and severity, size, and direction of spread of the fire. During the large fire, with widespread evacuations, many of the local informal networks were disrupted. Local residents' needs were for real-time, place-specific information. With changes in communication technology, the public has multiple pathways to explore to discover the information they need. To increase the likelihood that the public will discover real, accurate, and timely information, it is critical to disseminate the kinds of information people need at the appropriate times and through multiple information pathways.

Keywords: Fire, wildland urban interface, communication, quick-response research.

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Introduction

Increases in the severity and frequency of wildland fires during recent drought years in the West have coincided with growth in both housing developments and recreation in wildland areas (Rudzitis 1999). The results of such a convergence in 2003 were large composite wildfires, especially in southern California, that threatened communities, strained firefighting resources, and caused evacuations from many cities and towns. The intensity, size, and proximity to populated areas of these wildfires demanded unprecedented levels of communication among agencies and between agencies and the general public.

During natural disasters, the affected public seeks information from official sources, but also from family, friends, Web sites, and community members.

During natural disasters, such as wildfire, the affected public seeks information in their attempt to understand the disaster and its dangers. They try to obtain information from official sources, such as agencies, but also from informal sources such as family, friends, Web sites, and community members (Fitzpatrick and Mileti 1994). The most critical aspect to communication during a crisis is for the managing agency to respond quickly to the crisis with accurate, timely, and open communication (Barton 1993, Dougherty 1992, Fitzpatrick and Mileti 1994). Furthermore, the messages that agencies send to the public must be ones that the public can understand. This entails using everyday language, instead of government acronyms and jargon, and distributing information through many communication channels (Fitzpatrick and Mileti 1994, Waugh 2000).

This study focused on communication at all stages of a wildland interface fire because this topic represents a gap in fire social science research literature. Researchers in natural resources have studied public knowledge of wildfire (Cortner et al. 1990) and public perceptions of risk, responsibility, and blame (Carroll et al. 2000, Gardner et al. 1987, Taylor and Daniel 1984). A study closely related to this one looked at how blaming behavior affects communication between agencies and the public during wildfire (Kumagai et al. 2004). However, very little research has studied information-seeking behavior during and immediately after a wildfire event.

Communication needs emerge rapidly and change quickly during a wildfire event, therefore research that takes place during the event is crucial. This type of research has been termed "quick response research" by researchers of other natural disasters (Michaels 2003). Quick-response research is conducted during and immediately following a disaster event. Pre-event planning and rapid implementation of this kind of research is important to ensure that events critical to the study are captured without interfering with emergency response teams or jeopardizing public safety. This quick-response research study of two wildfire events in the San Bernardino Mountains in southern California evaluated the

communication needs of the public in this wildfire context and explored current agency responses to those needs.

Background

The San Bernardino National Forest had experienced an extreme drought over the 5 years preceding 2003 that resulted in tree mortality from insects and disease (Dietrich 2003). In response to the tree die-off, which one fire management officer termed a "slow-moving disaster," the U.S. Department of Agriculture Forest Service (USFS) initiated several fuel reduction projects. Coordination of these projects and other fire mitigation efforts enlisted a diverse range of agencies and community groups and served as a catalyst for community discussion about wildfire and forest health.

An important development in the San Bernardino Forest area was the organization of two types of collaborative organizations: interagency and community-based. These two types of collaborative groups were important in wildfire preparedness planning and response because they allowed communities to better mobilize and coordinate resources and communicate with everyone involved during wildfire events (Sturtevant et al. 2005). One organization created in the San Bernardino Mountains area was the Mountain Area Safety Taskforce (MAST), which included representatives from federal, state, and local government agencies as well as various community service organizations. The MAST helped many participants who would be in charge at various stages of a natural disaster to understand how to deal with shifting authority during wildfire and how all entities involved would coordinate and communicate. In addition to the MAST, Fire Safe Councils (FSCs) were organized in several mountain communities. Since 1993, FSCs have been created throughout California to help communities protect their physical and natural resources from wildfire by using a multiple-stakeholder, locally based approach (Fire Safe Council 2005). In San Bernardino, the FSC organizations were linked to the MAST and developed networks within their constituent communities, providing prearranged connections between communities and agencies.

The Fire Communications Research Team wanted to study fire communication before, during, and immediately following a wildland fire using quick-response research. Ideally, the team sought a wildland interface area where the known wildfire potential was very high and where significant prefire communication and organizational planning were already taking place. Communities in the San Bernardino Mountains in southern California met those criteria.

In September 2003, the Bridge Fire started in the foothills of the San Bernardino Mountains. This fire was active for 2 days and burned 1,352 acres, but with no loss of structures. This fire was both relatively small and of short duration,

resulting in a fairly small number of residents being evacuated (1,500), affecting only two communities. In October 2003, the Old Fire began in Waterman Canyon near the base of the San Bernardino Mountains. As this fire grew, and eventually merged with the Grand Prix Fire to the west, it became a significant portion of the notorious firestorm that swept across hundreds of thousands of acres in southern California that fall. The Old Fire moved progressively upslope into the San Bernardino Mountains. The Old Fire/Grand Prix Fire complex burned 150,729 acres in 2 weeks and greatly affected residents of the San Bernardino Mountain communities. More than 1,000 structures were lost and 45,000 residents were evacuated from their homes.

Our initial research questions for this quick-response research were the following: (1) What information sources are used during a wildfire threat, both to gather information and to disseminate information? (2) What message content is critical during what stages of a wildfire event? (3) How does mass-media communication differ from interpersonal information pathways?

Methods

Our initial research questions for this quick-response research were the following: (1) What information sources are used during a wildfire threat, both to gather information and to disseminate information? (2) What message content is critical during what stages of a wildfire event? (3) How does mass-media communication differ from interpersonal information pathways?

The Fire Communication Research Team traveled to the San Bernardino Mountains in September 2003 to study the prefire communication process. Coincidentally, the Bridge Fire occurred the same weekend. This gave the team the combined opportunity to study prefire communication preparations as well as the effectiveness of the during-fire communication process during a relatively small fire. Research team members interviewed residents and agency personnel and participated in a focus group discussion following a public meeting of the Running Springs FSC. A "snowballing" method was used to identify key personnel and residents to interview. Fire mitigation pamphlets, official fire reports, and other informational materials were also collected.

The research team again traveled to the San Bernardino area in October 2003, after the Old Fire began just north of the city of San Bernardino. As a result of an all-mountain evacuation during the Old Fire/Grand Prix Fire complex, affected community members were scattered across a multistate area, and thus most were inaccessible to the research team. Further, because the first guiding principle of the research team was to "do no harm," the team stayed out of the way of firefighters and communities during the fires. Instead, the team acted as participant observers to the information coordination process of a Joint Information Center (JIC), which was set up to coordinate communication information officers of the different fire incident management teams as well as information to the public, media, and

legislative liaisons from a single location. Research team members attended internal briefings at the JIC among three participating fire teams, organizational meetings among fire information officers (IOFR), and two MAST meetings. Team members observed public briefings held at evacuation centers and a public meeting held 1 day after reentry for Big Bear residents. The team also conducted interviews with staff and volunteers at the JIC toward the end of the evacuation period and the start of reentry. This timing allowed the team to capture experiences and perceptions of people involved in the public communication process while the experience was still recent and clear in their memories.

In March 2004, the Fire Communications Research Team returned to the San Bernardino Mountains to moderate focus group discussions with residents from several communities who experienced the Old Fire or Grand Prix Fire. During this visit, the team collected information on communication needs during fire evacuation and reentry as well as communication needs during postfire recovery. The team met with eight focus groups that included some residents who had been interviewed during the previous work in the mountain communities. More detailed information about this study can be found in the project report (see Taylor et al. 2005).

Results

Prefire Communication

In the San Bernardino Mountain area, significant prefire communication planning had already taken place prior to the fire events we report here. Agency personnel reported having worked out ahead of time the sequence of authorities and responses in the event of a wildland fire. Thus, interagency conflict was greatly reduced. "Things we usually have to try to figure out during the fire event had already been negotiated" (Running Springs Fire Department, September 10, 2003). "Things like transitions of authority had already been 'table-topped,' so we knew what to expect" (sheriff's department, September 11, 2003).

One of the FSCs' functions was to pass pertinent fire information on to other community groups such as the chambers of commerce. This communication exchange was facilitated by overlapping memberships among community leaders. People who had disaster responsibilities in the community reported the value of this prefire planning. Through the FSC information pathways, the public at risk felt more informed on how the event should proceed.

Respondents reported that communications among agencies and between agencies and residents in the mountain communities were substantially more effective during these fires as a result of preparations made by the MAST and the FSCs prior

to the events. The existing communication patterns that had been established to deal with the widespread die-off of trees as a result of drought, disease, and insects added to the effectiveness.

Communication During a Wildfire and Community Evacuation

The Bridge Fire was of short duration, and community evacuations were few and short. Residents were thus able to seek information from sources that were locally convenient during the course of their everyday routines. Initially, when the fire had potential to become a high-level threat, people took actions that had been discussed by the MAST, the FSCs, and community liaison officers prior to the fire.

The community members who were interviewed reported accessing multiple local sources of information about the Bridge Fire. The Old Fire/Grand Prix Fire complex was of long duration and necessitated the evacuation of all the mountain communities. Focus group respondents affected by those large fires reported using information sources that responded to the urgency of the situation in which entire communities were preparing to evacuate.

At the beginning of the fire event, the main information needs identified by the public were: Where exactly is the fire? How bad (how big) is it? In which direction is it moving?

At the beginning of the fire event, the main information needs identified by the public were: "Where exactly is the fire?" "How bad (how big) is it?" and "In which direction is it moving?" These items are important for determining, "Are my home and community at risk?" and "Will we have to evacuate, and when?" To be answered satisfactorily, these questions require specific, real-time information. Any fire information that was too general, either spatially or temporally, had little value to people who were trying to ascertain how much they would be directly affected by the wildland fire. Later during the event, when residents had been evacuated, the primary public concerns changed to "Has my community been affected?" "Has my home burned?" and "When can we go home (if we still have one)?" Again, people were requesting answers to these questions that were real-time and place sensitive. Once people were evacuated, it became more difficult to receive information that was up-to-date and locally accurate. Members of the Mountain Rim FSC were evacuated and scattered, making it difficult for them to assist and contribute to fire information efforts in the same manner as they had done during the Bridge Fire.

During both the Bridge Fire and Old Fire/Grand Prix Fire complex, information was available to the public through twice-a-day fire information news releases from the Incident Management Team (IMT). The Incident Command System ICS 209[8]

[8] ICS 209 forms are filled out by the IMT to keep track of pertinent information about the fire and how many and what kind of resources are assigned. The forms are typically produced twice each day. They are often used by IOFRs to prepare news releases, but that is not the principal purpose for which the forms are maintained.

releases contained technical information, rather than specific fire information that would directly address public information needs. Releases included information about the IMT assigned to the fire, when the IMT took over management of the fire, who was in charge, plus how many firefighters and how much equipment was assigned to the fire. Information about the location, direction, and size of the fire was very general and lacked local specifics that would be useful to community residents. Residents found those official communications about the fires contained little information that was useful to them.

At times the communication goals of the IMT appeared to conflict with the public's information needs. The IMT fire information officers reported trying to ensure the validity of the fire information message, and to "speak with one voice." The ICS-209 calls for sending out information that is rationally and cognitively structured in predetermined time increments. Affected local residents, whom the team interviewed, reported that their search for information was urgent and emotionally driven because of what was at stake for them. They sought real-time information, but with far less concern about whether the information was officially sanctioned. This is not meant to imply that the public does not care about accuracy of information, but they do express an urgent need for "real time" information.

Evacuation centers can act as information hubs for residents during a fire. In the Bridge Fire and Old Fire/Grand Prix Fire complex, public meetings were held at the evacuation centers to inform residents about the fires and suppression progress. For the Bridge Fire, these meetings were arranged by the MAST and the FSCs on day 2 of the fire. The fire briefing was characterized as very successful by participating officials, in part because most involved agencies were represented and a large audience attended. However, that briefing was characterized as uninformative and redundant by a few nonagency participants.

During the Old Fire/Grand Prix Fire complex, the IMTs coordinated briefings at the evacuation centers set up by the American Red Cross. A briefing at the Apple Valley High School evacuation center was attended by approximately 130 persons who were sheltered there. The briefing in the airport hangar shelter in San Bernardino, however, reached only a small portion of evacuees, perhaps 100 of the 2,000 housed at the hangar shelter and of the 40,000 evacuees registered at that center. Virtually none of the evacuees who were camping outside the hangar knew about or attended the briefing.

The public's perceptions of information access at the centers differed widely. Some community members who had moved to the centers felt they received more timely information than people who were not at the centers. On the other hand, a few people at the centers said they rarely received up-to-date information

and would go several days without getting any new information about the fire. Furthermore many evacuees at the centers who spoke only Spanish appeared to have difficulty receiving up-to-date information. The few onsite interpreters available at the evacuation centers were brought from the Mexican Consulate and had difficulty interpreting locally specific information because they were not at all familiar with the San Bernardino Mountains.

Another central source for information was the JIC. Information was brought into the JIC from multiple sources: IMTs, IOFRs, the American Red Cross, legislative liaisons, the Federal Emergency Management Agency, and the Forest Supervisor's office. The information was organized, verified, and then distributed by the JIC to its community phone bank, media contact lines, evacuation centers, and legislative staff. Generally, the information sources supplying the JIC continued to also distribute information through their own channels. The JIC was not always notified first or even at the same time when events or plans changed. As a result, people operating the public phone lines sometimes had incomplete or out-of-date information.

- "Channels 6 & 38 (disaster information channels) had the same information up for 15 hours and it was too generic" (Running Springs, September 12, 2003).
- "The Fire Information phone line (recording) is not updated during the day. FS updates at 6am and 6pm. Not enough for people who are affected" (Running Springs, September 10, 2003).
- "San Bernardino County Fire had a switchboard that you were supposed to be able to call. Unfortunately, it was busy but when you would get into the switchboard...they didn't have manpower to update the information" (resident, Lake Arrowhead, March 23, 2004).

This lack of up-to-date information was also reported by phone operators. Many callers wanted to know if their homes had burned, but it was not possible for phone operators to provide this information. People were unhappy when they could not get information about whether or not the fire had reached their communities.

This lack of up-to-date information was also reported by phone operators. Many callers wanted to know if their homes had burned, but it was not possible for phone operators to provide this information. People were unhappy when they could not get information about whether or not the fire had reached their communities. That lack of up-to-date information from official sources was a consistent complaint heard throughout this fire communication study. Sometimes callers had more up-to-date information than the phone operators, leaving the operators unable to verify what the callers had heard. It was demoralizing when operators later discovered that the caller had been correct. "Being at the JIC was almost more frustrating than doing nothing. The amount of information was limited—the official agency information is sterilized, sanitized to reduce liability" (resident, Running Springs, March 24, 2004).

In addition, operators reported that they occasionally overheard informative conversations among other JIC personnel, but were not allowed to release the overheard information immediately. Since the operators' function was to keep the public as informed as possible, such delays—necessary perhaps for the JIC to verify information—appeared to undermine the confidence of both the operators and the callers.

Fire maps were helpful to both JIC staff and the public as a communication tool. Environmental Systems Research Institute (ESRI)[9] had personnel stationed within the JIC to interact with fire personnel and provide quick-time map production. In discussions with residents a few months after the fire, community members reported interest in seeing fire maps that provided sufficient detail as to which specific neighborhoods had been hit or spared by the fire. "You should be able to go someplace and find a map, hour by hour, of how the fire progressed" (resident, Lake Arrowhead, March 23, 2004). Very few of the fire-affected public we interviewed knew of the ESRI maps, and even fewer knew how to access them. At the airport hangar evacuation center, one local evacuee attempted to improve access to real-time information by setting up a Web-linked projection of the fire-map site on the wall.

The JIC was able to overcome some of the difficulties of getting timely and useful information to people in communities at risk. The JIC encountered some difficulties, in part because it was established after the fires were already underway. Some cooperating agencies were slow to shift their information functions to the JIC. Other cooperators did not always provide the center with critical information but continued to disseminate information primarily through their separate channels without coordination with the JIC. Even the special efforts to rapidly validate information could not always provide information close enough to real time to satisfy residents' needs.

In both the Bridge Fire and the Old Fire/Grand Prix Fire complex, it was apparent that public interest in fire information changed focus over time, but it did not lessen in urgency. Through the call-in lines and at public meetings, residents expressed frustration with the fact that updates on the fire came quickly at the beginning of the fire event but slowed considerably once the fire was under more control. Even if the fire movement was slowed, fire information still needed to keep pace with public requirements. The IMTs and the JIC worked together to gather intelligence and report it back to the JIC at the end of the day. This worked

[9] The ESRI is a prominent geographic information systems (GIS) producer, which has focused their expertise on developing fire progress maps and other tools of immediate importance to fire IMTs. The ESRI is headquartered in Redlands, California, and thus was able to deploy a GIS mapping team into the JIC.

well, although the time-lag from intelligence gathering to reporting to the public appeared to be too long from the residents' perspectives.

Communication During Reoccupation

At the JIC, the cooperating agencies worked out a procedure for timing and announcing community reentries that allowed an orderly return when each community area was declared safe. The San Bernardino County Sheriff's Office, one of the cooperating agencies, held the final authority to allow residents back into their communities. Part of this procedure included notifying police officers in charge of highway access to the mountains. However, reentry into mountain communities was perceived to be a problem by many people. Since reentry had not been as clearly outlined by the MAST as the evacuation, the various authorities appeared to be operating under different rules, resulting in confusion over how and when to allow residents to return home. Some residents reported following instructions such as, "Go to such and such location and get a permit sticker. Then go to the closure gate on the highway and the California Highway Patrol (CHP) will let you go through," only to be turned away by the officer at the roadblock. "So we get to the CHP and the CHP is not going to let us up because they didn't get the code" (resident, Big Bear FSC group, March 25, 2004).

Disruptions in information and communication can also come when fire management changes authority, which often occurs near the same time as containment and community reentry.

Communication During Transitions in Management Authorities

Disruptions in information and communication can also come when fire management changes authority, which often occurs near the same time as containment and community reentry. Fire Incident Teams are restricted by policy for safety reasons in how long they can work on a fire before being relieved. Also, as fire conditions change, the flow of authority and support shifts to different management groups. Authority moves between an IMT to a Burned Area Emergency Recovery (BAER) team and then back to the national forest or other land management unit during the course of the fire, containment, and postfire mitigation. As new officers debate who will take responsibility for the communication system, the public may realize a serious interruption in the flow of needed information. Sometimes to avoid breaks in information flow, the national forest or other land management agency may retain fire information authority. In the case of the Old Fire/Grand Prix Fire complex, the JIC was allotted the authority for the flow of information to the public, but it was not kept in place beyond containment. The IMTs and the BAER team overlapped, and here the residents reported an interruption in the flow of information.

Mass Media Communication

Problems in fire communication were also apparent in the media. Because there were few local news media sources, regional media based in Los Angeles and San Diego provided most of the reporting. Information disseminated through the mass media was frequently perceived to be inaccurate, emphasizing the sensational over the practical, and shifting away to new topics before the local need for information was met. As a result, people expected agencies to provide up-to-date, real-time, accurate information that the regional media sources were not providing. Most of the regional media did, however, supply relevant agency contact information in the beginning. An exception to these perceived shortcomings was a local radio station, K-Bear, which dedicated programming to coverage of the fire, with information collected locally and directed to local information needs.

Phone-bank operators reported a large proportion of calls complaining that the regional news media gave incorrect information. Community residents estimated that about 50 percent of media reporting was in error. Callers who reached the community phone bank expressed relief that they had found a source of reliable information. Phone bank personnel were frustrated that media outlets were using multiple sources of information, indicating some probable sources of inaccuracy. Gathering news from multiple sources is viewed as important by journalists because they can draw from the most available, up-to-date information, albeit of varying levels of accuracy and authenticity. Journalists rely on multiple sources to establish the veracity of information they report.

Residents reported that regional television and newspapers provided little information that was locally specific and useful.

Residents reported that regional television and newspapers provided little information that was locally specific and useful. In conversations with residents and emergency personnel, people reported that television commentators often talked without knowledge of where they were or of the real fire situation. Residents stopped watching because of what they perceived as sensational repetition.

- "Then when we get down the hill, and you're away from the radio and you're watching TV and seeing pictures…when they're (the media) west of Running Springs saying they're in Big Bear, you know, they're still 25 miles away and you realize that…you're not going to get good information this way."
- "I saw mine [house] burning on Channel 5. I saw my house burn on TV. As a matter of fact, I saw my house burn over and over . . . Over and over and over! Because they do that. They say: 'Oh, this our best shot.' You know, 'use this one.' And then people who were affected by that, they watch that thing just happen, kind of on into the night—it's just awful" (Rebuilding Mountain Hearts and Lives Community Residents, Lake Arrowhead, March 23, 2004).

A local media operator in the San Bernardino Mountains said that fire in the mountain communities only had "entertainment value" for Los Angeles television audiences.

> There's a new generation of news people. They were more interested in entertainment. They understand it's ratings that makes the money and keeps their job and it has nothing to do with getting the information right.
>
> But to describe one person's disaster is another person's entertainment. And I think it is really true in the Los Angeles market, because you got approximately 12 million people and maybe 200,000 people were affected here, so it's not a very big percentage that they're worried about getting information right for. They're interested in getting entertainment right for the rest of the 11 and a half million people who were watching the TV to try to get ratings [resident, Big Bear FSC group, March 25, 2004].

In public meetings after the fire, residents applauded the local radio station for providing useful and up-to-date information during the evacuation. The station manager said that as a small, local radio station, he had an obligation to the community. Thus he went out of his way to get information and to update it frequently. When the station manager had to evacuate, he continued providing fire information via the radio Web site.

Locally operated Web sites dedicated specifically to the Old Fire were often cited as sources of valuable information for affected communities, both before and after evacuation. Web sites most frequently cited were <Rimoftheworld.com> and <fireupdate.com>. Both of these Web sites worked to provide real-time and place-specific information to mountain residents.

> Fireupdate.com was established by a mountain resident, "Ranger Al," who refused to evacuate. Ranger Al checked on a friend's house and once word was out about what he did he was inundated by phone calls. His son set up the Web site so that Ranger Al could post addresses of houses that had burned and those that had not. Although the fire officials did not want the information he had collected, the public did [Rim Family Services: March 25, 2004].

From focus group discussions, researchers found that only the locally based broadcast media plus a few selected Web sites were considered consistently useful and credible media by residents during the prolonged evacuation and confusing reentry period.

Conclusions

Communities at risk of wildland fire would benefit from developing communication plans before a fire strikes. These could be developed as part of community wildfire protection plans. Local, informal information pathways were effective at keeping large numbers of people informed during the Bridge Fire and worked well to quickly mobilize people to attend community meetings. Communication plans should specifically address means of activating local networks and keeping them informed with timely and useful information. The FSCs, especially in southern California, are organizing themselves to be qualified and trained to serve local expertise functions during wildland interface fires. Other local residents may want to follow this lead. This contribution needs to be accepted and supported through agency collaboration.

Communities at risk of wildland fire would benefit from developing communication plans before a fire strikes.

There is a tendency by many organizations and government agencies to hope for control over the quality of information that travels through the media and informal networks in a natural disaster situation such as a wildland fire. In today's communication environment, that is neither an achievable nor even a desirable goal. Instead, by establishing a goal of "informing the network" fire information professionals can focus more on their responsibility as providers of up-to-date, accurate, and real-time fire information. Special attention to communication efforts during evacuation, times of management transition, and reoccupation will be particularly important for the affected public.

Inform the Network

Wildland interface communities are served by relatively complex information networks that go well beyond traditional media. Those include Web sites of local businesses and organizations, interpersonal networks, and a variety of local media. Residents rely on these networks heavily during fires. They seek information from the networks and add information to the networks. The need for fire officials to relay warning messages through multiple channels, to increase comprehension and encourage residents to take needed action, has been well documented in the hazards communication literature (Turner et al. 1981). The social-psychological processes in fire communication are reflective of the processes that occur in other risk communication systems. This study found that the use of multiple information pathways is especially important during evacuation and reentry periods. Fitzpatrick and Mileti (1994) emphasized that the most effective forms of risk communication respond to the desire of those at risk for personalized warning messages and for consistent messages from multiple sources. In addition to the traditional media mix, citizens are adding their own news accounts of the wildfire event through

cell-phone networks, Internet Web sites, and e-mail lists (Gillette et al. 2007). The lack of adequate crisis information in the regional media further emphasizes the need for agencies to provide that information and to find methods for sending it more effectively through local media and informal information pathways.

Implications:

- Official messages are in competition with many other channels, messages, and sources. If the official message is to succeed, it must be useful, credible, and timely.
- Arrangements can be made to map the informal information networks used by the public and to find ways to provide these pathways with accurate and timely information.
- Even when quick-response information is provided, special efforts are apparently necessary to plug into the networks community residents use. This will require knowledge of the networks used by community residents and active efforts to link to the sites they use.
- Advanced communication technologies, such as cell phones with Internet and photo capabilities, can be incorporated along with bulletin boards, community meetings, and mass media for communication.

Residents of communities near wildfires feel an urgent need for timely site-specific fire information that will help them cope with the threat to their families, lives, safety, property, and interests.

Real-time information—

Residents of communities near wildfires feel an urgent need for timely site-specific fire information that will help them cope with the threat to their families, lives, safety, property, and interests. Agencies need to expand and reinforce those fire information functions that provide information to communities near the fire, especially those where residents perceive a direct threat from fire and smoke. In fire management policy, for wildland interface fires, the first and most important fire information role is to provide those whose families, lives, safety, property, and interests are potentially endangered with timely but accurate information needed for them to cope effectively with the threat.

If the need for real-time information is not fulfilled by the agencies, people are more likely to rely on alternate informal information networks fed by both trusted sources and public rumors. If the JIC or an alternate fire information structure is able to provide more immediate information from its multiple sources in a frequent, regular manner and assure that their fire information is received and disseminated by various communication channels, more people are likely to rely on fire agency contact points as their main information source during a fire event. Specially trained information officers or community liaison personnel could be deployed to the fire to gather real-time information and immediately communicate it to the JIC for dissemination to the communities at risk.

Metric Equivalents

Acres = 0.405 hectares

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Fire Information for Communities at Risk in Interface Wildfires: Lessons Learned From the 2003 Southern California Megafires

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Abstract

Community residents and other people whose interests are threatened by wildland-urban interface wildfires need immediate and continuing information to protect themselves, their families, and property and to cope with the health, psychological, social, and economic dangers that wildfires and other disasters present. Studies during the 2003 wildfires near San Bernardino, California, highlighted shortcomings in incident information and suggested ways to correct them. Practical recommendations to improve communication with people and communities at risk during interface wildfires are described here. Most important among the findings is that information must be provided continuously as the incident unfolds. People demand and need real-time information.

Keywords: Information, communication, wildfire, interface, disaster.

Introduction[5]

As soon as wildfire erupts in the vicinity of wildland-urban interface communities, people in those communities begin to seek information about the fire. They experience an urgent need for information specific to their neighborhood. The fire will disrupt normal activities, perhaps endanger families and property, and require them to act quickly to protect their families, pets, property, and themselves. They will need to tell absent family about the threat and plan how to coordinate their actions. They use whatever information sources are available, including mass

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[5] Observations and recommendations in this article, based on the results of research reported by Taylor et al. and Gillette in this volume, are applied by the authors in response to incident information and community action experience on major wildfires.

media, personal observations, news from friends and neighbors, overheard radio messages exchanged among firefighters, and official communication channels such as contacts with local fire and police departments and fire information (Taylor et al. 2005). Very few people remain passive information receivers. Faced with a wildfire, people actively seek information, share it with others, discuss and interpret it, and try to make sense of the developing, dangerous situation (Weick et al. 2005).

Although supporting demands for information from mass media remains a central job of the fire information officer, community information now requires as much attention and effort whenever structures or other community values are threatened.

Fire information officers[6] have adapted to the increasing demand for information as wildland-urban interface fires grow more frequent, dangerous, and destructive. Although supporting demands for information from mass media remains a central job of the fire information officer, community information now requires as much attention and effort whenever structures or other community values are threatened. An important fire information goal in wildfires and other disasters is to provide people who perceive their lives, property, and interests to be threatened with the information they need to protect themselves, their families, and their interests, and to cope with the health, psychological, social, and economic consequences of the fire.

As the electronic communication revolution continues, people faced with potential disaster and those recovering from disaster have new information options. Only a few years ago, community fire information[7] relied on mass media, key community contacts and neighborhood social organizations, community information boards in key locations, and community meetings supplemented occasionally by information officers circulating in communities. Today people use all of those channels plus cell phones, digital cameras, Web sites, e-mail, blogs, scanners, land-line telephones, text messaging, YouTube and pod-casts. People can be reached instantly and can just as instantly communicate with other people. Real-time information exchange, fact or rumor, is reality in wildland urban-interface wildfires.

Because people can gather, process, and share information so easily, they do not have to wait for mass media coverage to learn what is going on, how it will affect them, and what they can do about it. This means that available information

[6] Fire information officers are also known as incident information officers. As incident management teams assume all risk responsibilities and are more closely linked with the Office of Homeland Security, they are now known as public information officers. However, to prevent confusion with agency public affairs officer and public information officer roles, in this article, they will be referred to as fire information officers.

[7] The term, fire information, will be used here to refer to the public information functions of incident management teams and agencies. As an entity, "fire information" will refer to the collective of public information officers officially assigned to work on an incident including those with the incident management team and those working for local agencies and state and federal agencies or nongovernmental organizations whose assigned tasks include providing information about the fire to the media or directly to the affected publics.

and its quality are less under the control of official sources and mainstream media reporters and editors. A great deal of information quickly enters circulation as the fire threat evolves. Some of it is high quality and some is of doubtful validity and accuracy. Nevertheless people are widely and quickly exposed to it.

Official sources, such as fire information, are still preferred sources because they are widely believed to be credible, at least at the outset. However, unless information is immediately available from official sources, other sources will be sought, and official sources may be relegated to relatively minor status (Taylor et al. 2005). This is a major change in the fire information social environment associated with the growth of the new media by which people create and disseminate their own news coverage and editorial comment. Information officers must now seek to become part of the rapidly developing electronic and social networks that emerge related to the fire and establish official fire information as the preferred site to validate information circulating in the community's social networks.[8] The job is to map, join, monitor, and inform the informal information networks and to do it very rapidly following the start of the fire.

Real-time information is essential. Fire information even hours old may be next to useless to people trying to make sense of what is happening and to react to the rapidly changing fire situation. People still use the mass media, but they increasingly rely on Web sites, both official and personal. Radio and television stations that carry live reports from the fire and threatened communities find appreciative audiences. Often, however, residents complain that the coverage seems sensational, directed to a regional audience and not to those most affected, more entertaining than informative, and sometimes inaccurate[9] (Taylor et al. 2005).

Real-time information is essential. Fire information even hours old may be next to useless to people trying to make sense of what is happening and to react to the rapidly changing fire situation.

[8] People in communities are linked to each other in informal webs of information and influence exchanges. Communication may take place over telephones, e-mail, by word of mouth, or any other of many different media. Information is exchanged within the Web. It is also "possessed" through discussions. Meaning is interpreted and elaborated. Credibility is evaluated. New information is worked into the evolving stories that explain what is happening, and existing ideas are reevaluated. Fire information never communicates with just one person—communication is virtually always with a network of interlinked and interdependent people.

[9] These problems are different on interface fires in larger urban areas than in more rural areas. Local media in smaller communities frequently dedicate much of their broadcast time to fire coverage and are ready to interrupt regular programming with fire-related messages and updates. However, in rural areas, radio stations are sometimes preprogrammed and are not staffed, so they cannot provide real-time fire coverage. There may be no local media in many areas. In these situations, people in threatened communities rely even more on interpersonal communication networks to monitor the fire and for information that they need to make decisions about protecting their property and avoiding injury. Information boards, community meetings, and other noncommercial, local media can meet more community needs in less urbanized areas.

Especially in large urban areas, established mass media are no longer the best means of communicating with communities at risk. Even the public meeting, information boards, and telephone banks fail to meet the need for real-time information for many. The sheer numbers of people who call in for information can exceed fire information capacity to respond. Communicating through local informal networks of interlinked Web sites offers a way to leverage scarce information resources. Local networks also provide essential feedback. Too often, people find that official information does not address their immediate needs and is not targeted to the specific communities at risk, the decisions people need to make, or concerns about endangered values. Seldom is the information on the incident command system 209 form[10] helpful to people in threatened communities. Information officers need to determine what questions are high on the public agenda and quickly respond to them. Fire information officers need to adapt to the new media and active involvement of citizens in information gathering, processing, and sharing.

- **Effective links to the people on the fire line.**
- **Establish a fire information Web site.**
- **Establish an intelligence group within fire information.**
- **With smaller population, establish e-mail lists.**
- **Train information officers as reporters.**
- **Disseminate real-time information through as many channels as possible.**

Real-Time Information

People whose interests are threatened want to learn about the current fire situation as they need the information. They are seldom willing to wait for a news release issued twice per day (Taylor et al. 2005). Fire information should be organized to rapidly acquire accurate information about the fire and significant locations such as neighborhoods or other community values at risk and immediately disseminate it in channels monitored by information users. The following are some ways to do that.

- Effective links to the people on the fire line must be established immediately in order to support real-time information. “All the network interfacing in the world does nothing if you ‘ain’t got the goods’” (Schramel 2007). “[Fire information] needs to be in solid with [operations] and planning. The [incident management] team needs to be reminded the public is in a crisis mode. Straight talk that is delivered with respect and consideration of what the public is going through is what the public will follow” (Quintanar 2007).

[10] The ICS-209 is a form used by incident management teams to record data about wildfires. It is updated daily. Many information officers use the 209 as a basis for their news releases and information boards, sometimes without adding much additional information.

- Establish a fire information Web site. The national Web site, InciWeb,[11] can be used, but the current format does not have specific community information options. Users need to be able to find their community on the front page and open up to detailed information specific to that location. If an established Web site is used (such as an agency site), it will be necessary to create a prominent link from the front page to fire information. The site URL will have to be widely communicated to the public. That can be done through mass media, flyers distributed in threatened neighborhoods, word of mouth, and by linking from popular Web sites in the area. The choice of name for the Web site is important. The name of the fire can be used if only one incident is involved. Where multiple fires affect the community, a name that will make immediate sense to local people and nonresident landowners needs to be selected. A generic name such as "incident information" will not be easily found by information seekers.
- Establish an intelligence group within fire information. Assign information officers to accompany division supervisors and structure protection groups. This has worked well in the past.[12] Equip information officers with cell phones and digital cameras so that they can photograph the situation and immediately post the photos and captions to the Web site with time-date stamps. If cell phone coverage is insufficient, laptops and digital cameras can be used. Video can be posted to sites such as YouTube and linked to the fire Web site. Sometimes, of course, cell phone coverage and e-mail connections cannot be made from the fire. In those cases, information officers should call in their observations and stories over land lines if they are available. Editing and presentation are not as important as getting the information out fast.

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[11] Inciweb is a national Web site on which federal fire management agencies increasingly post information about fires within their jurisdictions. Inciweb is designed to be easily and quickly updated by local personnel without particular training in Web site development. Photographs and maps can be attached. Extension to provide information about individual neighborhoods threatened by fire is not difficult.

[12] "Back in 2005 on the Cave Creek Complex in Arizona, our JIC assigned an Intelligence Branch, Media Branch, and Community Branch. Merle Glenn served as the JIC manager. This model worked well due to the Intelligence Branch calling in real-time fire updates to the JIC every hour on the hour so that PIOs who were supporting the phones could update the public and media as they called in" (Bear 2007).

- Not all fires involve the number of people affected by the 2003 or 2007 megafires in southern California. With smaller populations, it can be effective to establish e-mail mailing lists and provide frequent updates through that medium. This can be particularly effective in serving evacuees, owners of vacation homes, and other nonresident landowners.[13]
- Train information officers as reporters. Field information officers need to be able to collect information, validate it, and prepare objective, succinct stories in a matter of a few minutes. They need to be able to report the facts from the scene as the story unfolds. Human interest coverage or stories in larger contexts are not needed immediately by people facing the fire threat and can be left until time permits or left to the commercial media.
- Disseminate real-time information through as many channels as possible. Arrange with local radio and television stations to broadcast updates frequently. Fire information officers can call in from their field assignments to provide live updates. Radio and television stations should be given their numbers so that stations can call them for live updates as part of regular programming.

The Right Information

People interviewed during and following the 2003 fires in southern California complained that official channels seldom contained information relevant to their needs. Often it was too general. The location specifics and behavior of the fire were not detailed enough. Frequently, official information described changes in who was managing the fire, firefighting resources assigned, costs, and so on that was irrelevant to people in threatened neighborhoods (Taylor et al. 2005).

- Fire information for communities at risk needs to answer the questions that people have at the time.
- Field information officers should monitor the changes in felt needs for information among the different audiences. As the incident unfolds, information needs change and official information sources need to anticipate those changes and meet them with appropriate information. Learning who the key communicators and most informed people are in

[13] "I can move the world with my PC and 2 group e-mail lists ("media" and "folks") that I have already established. This is my hottest tool. Everything that goes out has a small personal message attached with a real name. It has made a world of difference. I can monitor questions real time. People in elevated anxiety need to know someone is out there" (Schramel 2007).

neighborhoods and enlisting their help to keep fire information up to the minute is useful. Asking questions of people who come to information sites, call in, or are simply encountered on the street will help track changes in information needs.

- Web site postings and blogs should be constantly monitored to both identify evolving information needs and identify misinformation that is circulating. Misinformation can be explicitly addressed on the official Web site, and corrections can be provided to key communicators in neighborhoods.

Informing the Networks

People in communities are tied together in informal webs of interlocking interpersonal communication. These social networks are familiar to information officers as the "grapevine" in organizations or neighborhoods through which rumors circulate. New media like cell phones, digital cameras, text messaging, blogs, and personal Web sites and e-mail have vastly increased the power of the grapevine to rapidly spread news.

Information enters community social networks through many links with the outside. Mass media messages directly affect only a few people in a community. Those people pass information on to their contacts that pass it on to others, in turn. This multistep flow of information and opinion has been well known since the 1950s and is used in public information campaign design.

Networks do more than pass on information. They also process the information. The credibility of the information is discussed. The community turns to its own experts to add to the information and put it in the community context. Some messages are featured on the local agenda and others are ignored. In retransmission, ideas and interpretations are added and some details may be changed.

Fire information will always be processed and disseminated through community social networks: it is critical to monitor the social networks for rumors and inaccurate information.

Social networks can be effective means of communicating with communities at risk if they are understood and systematically used. Fire information will always be processed and disseminated through community social networks. However, social networks also misinterpret messages, which are often altered as they are passed from person to person. It is critical to monitor the social networks for rumors and inaccurate information. If information officers use the networks effectively, they can take advantage of their power to spread information rapidly and, at the same time, overcome the problems of misinformation and rumors.

- Real-time information needs to be fed into the local interpersonal networks through links that will ensure rapid sharing. Identify key communicators in the interpersonal networks and Web sites that many people go to for fire updates and regularly contact them with new fire information.

- People in interpersonal networks have different roles. Some link the network to outside information sources. Some are opinion leaders and help judge the appropriateness of information and actions. Some link or bridge different cliques and strata. Learn who the key communicators in the different informal networks are and establish working relationships with them early in the fire.
- Part of the informal network is visible on the Internet, but most of it is hidden. Identifying opinion leaders in the communities—the people others check with about new ideas and information—helps because they know how information gets around the neighborhood better than most people do and can help introduce information officers to other key communicators.
- The principals of the local schools, the volunteer fire chief, religious leaders, local elected officials, the sheriff, and non-firefighters in the agencies can all direct information officers to key communicators. Once some of the key communicators have been identified, they can identify others. Probably no one person knows the whole informal network, but it can be mapped roughly by asking many different people to identify parts they are familiar with.
- Once key communicators have been identified, it is important to regularly call or visit them to let them know up-to-the-minute news about the fire and estimates of what it is expected do in the next hours or days. Even if nothing has changed, it is important to tell key communicators that. "No change" is important news to people concerned about threats to their interests.

Joint Information Organizations

Often in the wildland-urban interface, wildfire involves many agencies. More than one federal land management agency, a state fire agency, local fire departments, county emergency services, several county and city agencies, and the sheriff, highway patrol, and local police all may be communicating with the same community members about different aspects of the fire.

When more than one fire is burning in the area, more than one incident management team may be assigned. If information officers from the different teams are communicating about fires, confusion is sure to arise about road closures, possible evacuations, and the procedures for reoccupying evacuated neighborhoods. Confusing information can lead to dangerous situations for people in threatened communities.

- One solution is to establish a joint information organization (JIO)[14] to coordinate information from the participating agencies to the public. The JIO might be the central voice for the combined agencies with agency information personnel all under the same roof. Alternatively, it may serve as a unified information organization where agency public information officers and fire information officers meet at regular intervals to plan and synchronize their separate information efforts. Or it may be something in between.
- Local JIOs ideally will be established long before disaster threatens. Participating agencies will have well-established protocols for working together, and triggers to activate the organization will be known. Once the fire starts, it is difficult to build a functioning JIO quickly.
- The JIO can manage the unified Web site, operate call-in telephone banks, serve as a media clearinghouse and reception center, and provide many other services that overlap among responsible agencies.

Evacuation Communication

Evacuation creates serious communication problems. It disrupts the communities' informal interpersonal information networks. Access even to the traditional media is sometimes interrupted when power failures cause radio, television, and some telephones to shut down. With evacuation, residents' information needs change and intensify just as communication becomes more difficult. Some people will go to shelters managed by the American Red Cross or other disaster relief organizations. Most will scatter to the homes of friends or relatives or hotels in surrounding communities. Both the formal and informal communication processes established before the evacuation may no longer be effective.

- Evacuations are typically the responsibility of the sheriff or other local law enforcement official. Information planning for evacuation and reoccupation needs to be done in close collaboration with and sometimes under the direction of the sheriff.
- A communication plan to keep evacuees informed of fire developments in their neighborhoods and on surrounding lands should be developed well before evacuations are ordered. Before evacuation, residents in communities can be asked where they plan to go if evacuation is ordered. That will

[14] The term "joint information organization" is used here rather than the more common "joint information center" because many degrees of coordination are possible and JIC has come to mean a particular kind of joint information organization. Federal Emergency Management Agency has published details of how to organize a JIO that can be found at http://www.fema.gov/pao/joint.shtm.

allow identification of locations in which to establish satellite fire information centers, perhaps in cooperation with the American Red Cross, where evacuees can go to learn the latest about the fire. Often disaster managers are concerned that discussion of evacuation before it is needed will cause panic. However, it is clear from disaster research that panic is rare, especially when people can take actions that clearly are useful.

Community preparedness, evacuation, and communication plans are essential.

- Community preparedness and evacuation planning and education should be done as a part of community wildfire protection planning and prevention. All collaborating agencies should be engaged in planning and prefire exercises. The community needs to know evacuation routes, staging areas, and how to remain informed of fire developments before, during, and after the evacuation. Community communication plans are an essential part of evacuation and reoccupation plans.
- Evacuation warning and notifications need to be delivered with as much lead time for preparation as possible. People need time to collect things and to organize their families. Evacuations should be ordered early enough to permit orderly and deliberate removal. Last-minute, urgent orders that come as a surprise to residents will add to distress, result in hurried choices and decisions that are regretted later, and add to the danger of evacuation travel. Evacuation orders need to be stated clearly in plain language. It may be advisable to give the orders in more than one language depending on the languages spoken in the neighborhoods at risk.
- Fire information arrangements and facilities need to be in place and staffed when evacuees arrive in the communities where they will shelter. They will want information immediately. They need to know if their homes have burned and whether their families, friends, pets, livestock, and property are safe. Up-to-the-minute information is very important to people during evacuations. Rumors are likely to develop that worry people. Mass media stories may arouse anxiety and doubt. Information demand will be very high, and lack of information will feed evacuees' distress.
- Fire information officers should report frequently from evacuated neighborhoods. Photographs should be sent to each of the evacuation information centers and updated as often as possible. Probably no more than an hour should pass between updates from the neighborhood, especially while fire is actively threatening it. Even if there is no change in conditions, frequent updates are needed.

- When homes are burned or damaged, it is essential to get that information to the owners and occupants as soon as possible. Arrangements should be made with the American Red Cross for procedures to notify people of losses. People need to learn of their losses in private, preferably with emotional support immediately available. They should not learn that their home has been burned by seeing it on television or from a photograph posted on a Web site.

The Red Cross can provide counselors to help people cope with the loss. Photographs of the damage are useful, but some means to send them confidentially must be established. Again, the Red Cross can assist. Sensitivity to emotions and grief are important. People need to have access to all the information they want but not to be exposed to images and descriptions that they are not prepared for. However, the decision as to what information is needed is up to the receiver not the fire information officer. The information officer, however, has a responsibility to make sure that the information sent is accurate in every detail.

- Photographs, video, and detailed verbal descriptions are useful ways to communicate the developing situation in areas that have been evacuated. Live reports from the scene to local radio stations may be appropriate. Such reports can also be posted on the Web site. If the number of evacuees is not too large, it may be possible to telephone them from time to time to report on the status of their communities and property.
- It is very helpful to collect information on where people plan to stay during evacuation and telephone numbers where they can be reached. Land-line and cell phone numbers are helpful. When the information is collected—typically during preparations for possible evacuation—people can be given flyers with the names, locations, and telephone numbers of satellite information centers in communities surrounding the fire. Web site and other sources of up-to-the-minute information can also be included in the flyer.
- Regular face-to-face information briefings should be held at evacuation centers and satellite communication centers. Maps and photographs are helpful if they are frequently updated and frustrating if they are not.
- Expect that through the use of cell phones and other electronic communication technologies, informal interpersonal communication networks will quickly re-emerge among evacuees even though people are widely scattered. People will actively seek information from every source they can find, evaluate it, interpret and elaborate it, and share it with others. Plan

to be part of those networks and to keep them well informed. Monitor and facilitate communications in the networks through key communicators in the same way that was done in communities before evacuation.

Reoccupation

Reoccupation of evacuated communities should be as carefully planned as the evacuation, and a sound communication plan must be part of the reoccupation plan. Residents returning to a neighborhood that has been burned over will face safety and health issues, questions about how to deal with rotting food in freezers, injured wildlife, safe disposal of damaged building materials, proper care of heat-stressed trees and ornamental vegetation, security, insurance, rebuilding and repair assistance, and literally hundreds of other matters. Information demand is extreme immediately before and during reoccupation and recovery. The fire information problem is compounded by high levels of psychological distress and the resulting disruptive social effects. Information officers do not need to provide all this information—the businesses and agencies providing services will typically contribute personnel and resources for communication.

Unless the transition from fire information to whomever assumes the role is carefully planned and executed, information gaps and confusion are likely.

Matters are made worse by the fact that the fire information organization that provided information during the fire and evacuation is likely to be demobilized as the fire is contained. Unless local agencies replace the departing fire information officers, the communities are likely to be left without information when it is desperately needed. Under the best of conditions, a transition needs to be made between fire information and whatever organization will assume the role during reoccupation and recovery. Unless the transition is carefully planned and executed, gaps and confusion are likely to be experienced by information seekers.

- Make a reoccupation and recovery communication plan in collaboration with local agencies that will accept responsibility for continuing information functions following departure of incident management teams. Especially plan for a seamless transition between organizations that results in no interruption in information available to communities and others whose interests have been affected by the fire.
- Evacuees need to be informed of how and when reoccupation will occur. Because the dynamics of disasters ensure that changes in details are inevitable, methods need to be in place to revise information on short notice. Evacuees need to expect last-minute changes and know how to keep up with the latest instructions. If effective communication channels have been established during evacuation, this should not be difficult.

- It should be possible to restore communication relatively quickly through the community informal interpersonal networks. Public open houses should be held regularly and frequently at which recovery plans and operations are described and where insurance experts, disaster relief organizations, the Natural Resources Conservation Service, Small Business Administration, Federal Emergency Management Agency (FEMA), and other agencies, nongovernmental organizations, and groups such as property owners associations can answer questions. The open houses are opportunities for residents to get their questions answered. The tendency to turn it into a one-way public meeting or briefing should be avoided.
- Tours of the burned area that describe fire behavior at significant locations and firefighting actions taken at different points will help reduce misinformation and rumor. It will help people make sense of the situation and mitigate some psychological distress and associated negative social impacts.
- If local people are hired to assist with recovery work on public lands or if volunteers are engaged, the informal interpersonal networks can be effectively used to provide detailed postfire recovery information to the community and to advance fire education goals. Workers and volunteers will tell friends and neighbors about what they are doing and seeing in the burned area and what they are hearing from government employees and others about how the fire burned and why. If time is taken to describe to work crews what happened and why and how the mitigation work will contribute to recovery and restoration of the landscape, the informal networks can be very effective postfire information channels. Workers and volunteers can also communicate the changing information needs and concerns of the community back to the information officers.
- The Web site should continue to be used to inform the community during reoccupation and recovery. If fire information officers have successfully established their Web site as a reliable and trustworthy source of information, people will continue to use it to help address the new, postfire issues they face. Monitoring of changing information needs and links with other key Web sites important to community interests will help keep the site relevant and effective.
- Local and regional mass media are often willing to publish postfire feature stories that provide more detail about what is being done to restore the communities and landscapes. These can be particularly effective if they feature community actions that helped reduce losses and that are promoting recovery.

Separate Functions: Informing the Media and Informing the Networks

The problems of communicating with communities at risk during wildfires are much different from those of providing timely and accurate information to the traditional news media. The two audiences demand different kinds of information and have different deadlines. Different kinds of skills, training, and experience are needed to serve the media than are needed to support community information needs.

- Incident managers and information officers should clearly separate the two fire information functions.
- Specialized training should be developed and provided to information officers who will manage community information functions.
- Both the research available on disaster and risk communication with communities and the growing pool of experiences of fire information officers working in the wildland-urban interface should be incorporated in training.

Information Flow During Transitions

Wildfire management assignments change. Management may transition from local agencies to a national incident management team. During the fire, management may transition from one team to another and, as the fire is contained, back to the local units. Key personnel may change during the incident. Burned Area Emergency Rehabilitation (BAER) teams may bring their own information personnel to the fire. Whenever transitions are made, there is the likelihood that established community information functions will be changed or information gaps will occur. A gap of a half day may cause little difficulty for the media but can be serious for people in threatened communities or evacuees.

- Authority to manage the incident, including fire information, is delegated by local line officers in the cooperating agencies. During transition meetings, local agencies need to make clear how community information will be organized and function. If prefire preparations have been adequate, it should be relatively easy to provide the incoming fire information officers with guidelines and instructions. Many local areas have established joint information centers or similar organizations. Incoming fire information officers need to be instructed on the role of these organizations and how the information functions of the incident management teams are to be integrated with the local JIO.

- Local line officers may choose to continue to manage the fire information functions under their public affairs officer's direction or within a JIO already established. Fire information officers assigned to incident management teams may work for either the line officer of the responsible agency or the incident commander. Retaining the information functions by the line officer could be used more often, especially when several fires are burning in the area or more than one incident management team is communicating with the same population. It is difficult to prevent confusion among community residents when they receive messages about different fires from different teams that do not coordinate with each other. Residents cannot always differentiate between the sources of information or the incident to which it applies.
- When transitions are made or other official information sources are added to the mix, particular care needs to be taken to avoid disruptions in the information flow between fire information and the communities at risk. Incoming information officers should take care to integrate into established communication processes and introduce necessary changes in ways that permit information users to keep up. It is particularly important to keep the same telephone numbers and Web sites. When they must be changed, instructions need to be provided at the old site or phone number directing users to the new location. When new information centers are added to or subtracted from the mix, care needs to be taken to inform information users where they can find continuing information. When personnel change, new personnel should be briefed in detail, to the extent possible, on local informal networks and working arrangements and should be introduced to key contacts before the established information officer leaves.
- Use local people on telephones and in communities. This helps with the transitions and postfire work. Relationships may often exist between the local people working in fire information and residents of threatened communities, and this helps (Schramel 2007).

What residents do before, during, and after fires makes a difference to fire management success. To do their jobs well, they need timely, accurate, and plentiful information.

Priority of Fire Information Functions

Clear recognition is required of the role communities and the residents of the wildland-urban interface play in protecting their own properties, providing for their own and firefighter safety, rehabilitating and restoring burned landscapes, and reducing fire costs and losses. What residents do or do not do before, during, and after fires makes a difference to fire management success. To do their jobs well, these cooperators need timely, accurate, and plentiful information.

Prefire information planning and community preparedness makes a great deal of difference in the outcomes of fire information during the wildfire threat. Communities will be safer and suffer fewer losses if their residents are engaged in fire protection as full partners with fire and emergency management agencies. But, community information needs do not cease when the incident management team demobilizes; active communication with affected communities is just as important following a fire. Appropriate actions by residents and elected officials during recovery can mitigate future fire threats or make them worse. Community residents can contribute in many ways to rehabilitation of burned landscapes. Participation in rehabilitation and restoration projects can contribute importantly to the sense of well-being in communities distressed by the fire and its aftermath (Burns et al., in press). Communication is essential to successful collaboration.

It can be very difficult for the local information officers to provide the needed information support to communities following major fires. They are swamped with urgent work that accumulated while they were working on the fire. Arrangements need to be made to reinforce the agency's public affairs office for a time after the incident management team has left. Depending on the scope of recovery and rehabilitation and fire impacts on the communities—social as well as biological and physical—information demands will continue for months. Community information needs do not diminish much when the fire is contained; they simply change.

- Successful community fire information depends on the support of agency line officers and senior fire managers in state and federal land and fire management agencies.
- Information release to the public is sometimes delayed while it is being approved by line officers or incident commanders. Where this is a problem, some means needs to be developed by which approval for the release of community fire information can be expedited.
- Land management agencies with wildland fire responsibilities need to critically examine the resources allocated to information during the prefire, emergency, and postfire stages. Typically, few information resources are allocated during the pre- and postfire stages. There may be an unrealistic expectation that information officers assigned to incident management teams can manage the fire information demand without prefire preparations by local public affairs officers or postfire continuance of disaster recovery information.

- When wildfire has the potential to threaten communities, community fire information needs to be activated immediately with initial attack and rapidly expanded if the fire escapes initial attack. Local public affairs or fire management personnel need to make arrangements for information officers to respond immediately and to mobilize additional resources as needed as the fire situation demands.
- More resources should be committed to training public affairs and fire information personnel in community disaster communications especially as applied to wildland-urban interface fires. The benefits in increased public and firefighter safety, reduced property damage, and reduced firefighting costs made possible by a well-prepared and supportive community will, no doubt, far exceed the costs.

Conclusion

Public and firefighter safety are better protected in wildland-urban interface fires if community residents are well informed and act to leave their properties in the best possible condition for firefighters to defend. Evacuations and reoccupations function smoothly if people know what to expect and how to prepare. People are better able to cope with the practical problems of a fire disaster or the threat of one if they can quickly find and use information as their needs change. Psychological distress and associated social and economic disruption can be reduced if people can find the information they need and process it effectively to make sense of the dangerous and potentially destructive situations that emerge as wildfire in the interface unfolds. Both monetary and social costs are high in interface fires. They can be reduced when residents can take useful actions in support of their own defense and recovery.

The actions taken by residents and elected officials in communities following a wildfire can reduce the potential for future fire losses and costs or make the situation worse. Effective community fire information during and following the fire will make a considerable difference in the choices people make during community rehabilitation and restoration.

A well-designed and executed community fire information plan is an essential part of wildfire management in the interface. Agency policymakers and managers may need to commit more resources and enhance the priority of information to support communities in wildland-urban interface fires. The effort will need to be collaborative among all the agencies with jurisdiction or interests in the interface that are impacted by fire and its effects.

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An Organizational Structure for a New Communication Environment

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Abstract

In the past 5 years, the American public has participated in a fundamental reconfiguration of their communication environment. Through the use of new mobile communication technologies, citizens are actively shaping and producing news. Unlike traditional media, these media have no institutional framework for production. Instead, nonmedia professionals are producing innovative content at the local level within an open framework that allows them to rapidly redefine to whom and how they broadcast content. The open framework encourages inclusion, participation, and universal access. It is a fundamental shift away from the institutional framework in which most public communication professionals were trained. As such, most public communication professionals are ill-prepared to successfully navigate the new communication environment. Yet, failure to rapidly adapt to the new communication environment can have grave consequences, especially if failure to respond occurs during a crisis such as wildfire, flood, or other natural hazard event. In this article, a conceptual model of the new communication environment is presented to illustrate emergent nodes at different stages of a crisis. The model focuses on the emergent role of information brokers and how they broker information and other resources to bridge information gaps in public information. The conceptual model illustrates how different levels of public information brokers emerge over time to meet the needs of a public that is searching for locally relevant, real-time information.

Keywords: Information, communications, technology.

Introduction

In the past 5 years, the American public has participated in a fundamental reconfiguration of their communication environment. Although this transformation had been predicted for quite some time (Licklider and Taylor 1968, Rheingold 1994, Winner 1986), recent advances in technology combined with an increase in use have made it possible. In the 4-year period from 1997 to 2001, the number of people using the Internet and cell phones doubled, with almost 50 percent of the American population reporting Internet and cell phone use in the 2000 and 2001 U.S. Census (Newburger 2001). Through the use of new mobile communication technologies,

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citizens are actively shaping and producing news. Unlike traditional media, these media have no institutional framework for production. Instead, nonmedia professionals are producing innovative content at the local level within an open framework that allows them to rapidly redefine how and to whom they broadcast content (Gillmor 2004, Outing 2005).

In the new communication environment, relationships with media are more lateral than linear. The open framework encourages inclusion, participation, and universal access.

As a result, the new communication environment has disrupted the linear flow from public communication professionals to traditional media and their audience. In the past, a public communication professional would produce a press release for the media that would then be broadcast via well-known, established channels to a mass audience. In the new communication environment, the relationship is more lateral than linear. Information sharing is coordinated by a variety of actors, both media and nonmedia professionals. The open framework encourages inclusion, participation, and universal access. Home video coverage of a breaking news event can be as valuable as broadcast coverage from a major network. It is a fundamental shift away from the institutional framework in which most public communication professionals were trained. As such, most public communication professionals are ill-prepared to successfully navigate the new communication environment. Yet, failure to rapidly adapt to the new communication environment can have grave consequences, especially if failure to respond occurs during a crisis such a wildfire, flood, or other natural hazard event.

In the past 2 years, public information officers, fire information officers, forest supervisors, and incident command team leaders have had the opportunity to discuss the implications of the new communication environment. The impetus for the discussions came from results of a wildfire study conducted in 2004 in southern California (Taylor et al. 2005). Agency information officers are taking the initiative to adapt to the new communication environment even when the agency leaders remain unresponsive. In this article, a conceptual model for participation in the new communication environment is outlined in an effort to help agencies develop a flexible and responsive approach to the new communication environment.

In the past, when a crisis occurred, a meta-agency would form to respond to the information needs of the public. These communication configurations were often star shaped. The central group or node would consist of agency communication professionals who would collect information from agency crisis teams and then distribute it to satellite groups that consisted of media professionals and other relevant organizations (fig. 3). From an institutional perspective, the star configuration appeared to work because it helped control the flow and content of the information to other institutional players, traditional media, and organizations.

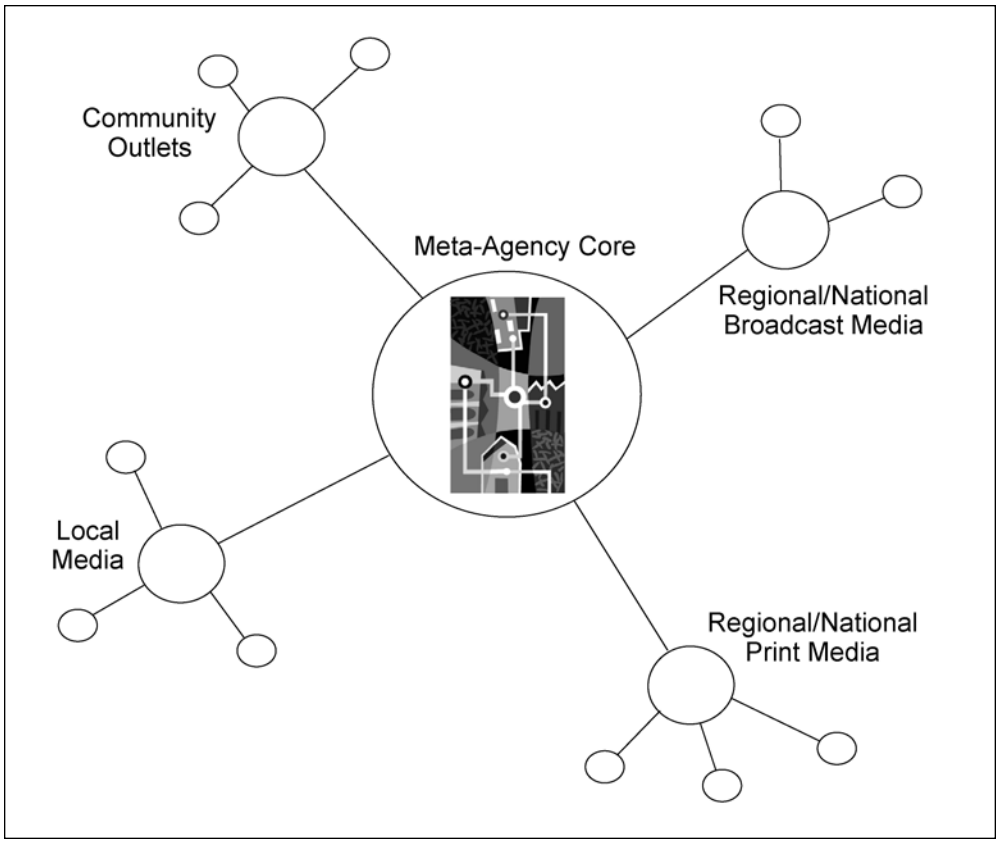

Figure 3—Traditional star configuration of communications.

In the new communication environment, the public searches for crisis information that is timely and very local. Unfortunately, the star configuration does not function very well in the new communication environment in which the public is searching for "hyper-local" content. Instead, the public is bridging the information gaps by identifying alternative information sources. In the resulting network context, more importance is placed on real-time, local information, thereby increasing the role that information brokers play in meeting the public's communication needs (fig. 4).

In this article, a conceptual model of the new communication environment is presented to illustrate emergent nodes at different stages of a crisis. Information for this conceptual model was informed by (1) qualitative research on fire communication (Taylor et al. 2005) and (2) the role of citizen production in the new communication environment (Gillette et al. 2007). The model focuses on the emergent role of information brokers and how they broker information and other resources to bridge information gaps in public information. The conceptual model illustrates how different levels of public information brokers emerge over time to meet the needs of a public that is searching for locally relevant, real-time information.

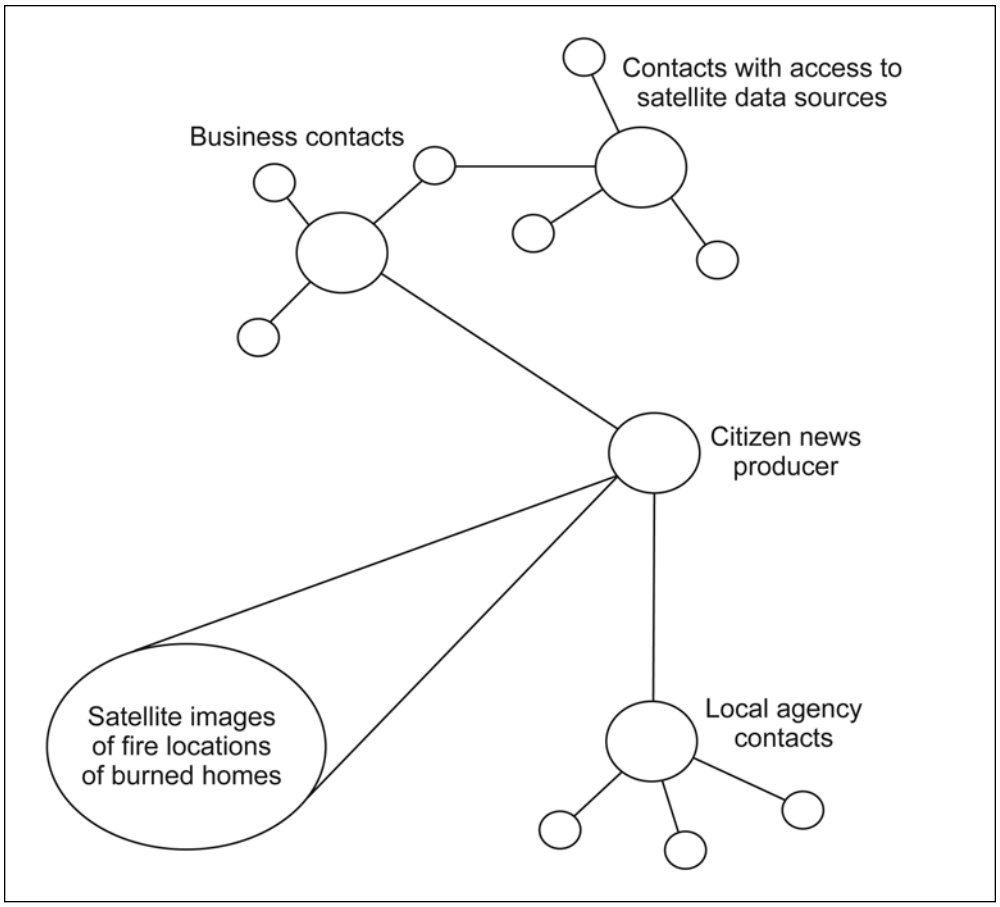

Figure 4—Citizen news producers filling informational gaps in the new communication network.

The basis of this conceptual model is derived from the work that has already been conducted on the role of information brokers in social networks. Burt (2004) found that the information arbitrage that brokers conduct across diverse groups leads to innovation. Katz and Lazarsfeld (1955) have discussed how the diffusion of ideas often occurs among "opinion leaders" who span diverse social groups. Granovetter (1973), Milgram (1967), Rees (1966), and Watts (1999) demonstrated the importance of bridging social gaps for accessing new information and new opportunities.

From the anecdotal evidence provided in our qualitative research, it appears that brokers may also play an important role in filling public information gaps during a crisis. When agencies and traditional media fail to provide locally relevant content in real time, information brokers are stepping in to fill the gap by synthesizing information from several information sources and distributing it in a format that is easily digestible for an interested public.

Ranger Al is an example of an information broker turned news producer who emerged during the Old/Grand Prix Fire complex that caused residents to be evacuated from their communities for a week. During the evacuation, residents found that their need for real-time and personal information was not being filled by the traditional agency and media outlets (Taylor et al. 2005). People who were staffing emergency call-in lines reported frustration with not having the most accurate and up-to-date information because of problems in information flow between and within agencies. Local people involved in the evacuation and reentry reported difficulty in conveying a consistent message when information was coming in from several sources.

Once evacuated, residents found that their media access was often limited to regional media accounts of the event, which were designed for a larger metropolitan audience. Evacuees reported frustration with sensationalized coverage of the fire in the regional media and the often inaccurate reporting of where the fire was and what communities were being affected.

Residents acknowledged the difficulty that the regional media faced in reporting a rapidly changing event, but couldn't understand how basic reporting skills appeared to be absent such as providing the correct name and location of areas in the news clip. Residents reported that they often saw news reporters from Los Angeles saying that they were reporting from one mountain community, when in fact the buildings in the background behind them were in another mountain community 30 miles away.

As the fire started to diminish and agency officials began to discuss reentry, news coverage from the regional media declined in frequency. The lack of news coverage made it more difficult for evacuated residents to find out how their communities had been affected and when they might be able to go back in.

Frustration with agency and media information sources turned residents to their cell phones and then to the Internet to fill the news gap.

Frustration with agency and media information sources turned residents to their cell phones and then to the Internet to fill the news gap. As discussed earlier, cell phone networks served as a source of information for evacuees. Some of the news producers on cell phone networks made the transition to the Internet as a way to supplement the information that they were already providing in a format that was accessible to more people. A local resident with fire experience remained on the mountain with essential emergency personnel when most residents had evacuated during the Old/Grand Prix Fire. Initially, he fielded calls from concerned evacuees who wanted localized, real-time information about the fire's progress and its path through the communities. When the calls became too frequent, he turned to the Internet to relay his information and took the moniker of "Ranger Al."

Residents attributed the popularity of the Web site to its information, which they characterized as immediate, personal, direct, and credible (from the perception of the residents, the news producer was credible because he had knowledge of fire behavior, and knew the local neighborhoods). People were able to remember the Web site readily because of its address, fireupdate.com, whereas the address of the official fire Web site referred to an agency term for a firefighting unit that was not familiar to most people in the general public (incidentcommand.com).

The popularity of Ranger Al's Web site extended beyond the evacuated residents. Friends and family members of evacuated residents visited the site for information, and its popularity spread as it was cited by regional and national media as a site for information. The *Los Angeles Times* wrote an article about Ranger Al's efforts, and his site was linked to other Web sites on the fire. When his access to areas on the mountains was to be curtailed, he used his new-found notoriety to negotiate his status as a legitimate news producer and his right to remain on the mountain and visit affected communities.

After the fire, the moniker of Ranger Al continued to have a presence on the Web through the Web address, firerecovery.com, which provides locally relevant information on the recovery efforts after the fire.

Another resident, with no experience in fire and only a few years in the mountain community became a news producer after becoming frustrated with the visual map information that was available. It was not specific to the local area and it did not appear to be updated very often. The resident transformed from a frustrated media consumer to a news producer when a distant friend contacted him to find out how he was (the friend had seen national coverage of the fire on television). When the friend was told about the frustration with maps of the fire, he provided a link to a satellite map. The resident's local tourism business Web site became a site for news about the fire from a satellite map.

The information brokers described above created value from information derived from many sources. The information was valuable to the public because it provided the locally relevant, real-time information that wasn't available through traditional information channels. As a result, these emergent news producers became information sources for evacuated residents who were seeking information. The information brokers synthesized information from diverse groups and delivered it in a desired format that could easily be digested by members of the interested public.

The new communication environment has served as an incubator for information brokers to emerge as news producers. Internet and cell phone

networks provided remote access to data and information through an easy-to-use interface. As a result, citizen news producers have access to electronic information from a wide variety of sources.

Nontraditional news production in the new communication environment is often ephemeral, forming in response to a short-term need and dissolving once the crisis is over. By understanding how and why certain information brokers become news producers during a crisis, agencies can more effectively participate in the new communication environment.

Reynolds and Seeger (2005) described the stages during a crisis as (1) pre-crisis, (2) initial event, (3) maintenance, (4) resolution, and (5) evaluation. Agencies have the opportunity to participate more fully in the new communication environment by identifying potential nontraditional news producers, engaging them in an exchange of information, and building trust and respect.

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The Communication Environment

Pre-crisis

In this stage, alliances are formed among agencies, organizations, and groups to develop communication plans for evacuation and reentry. The public is not actively looking for information during this period. Instead, agencies are reaching out to the public through communication and education campaigns to convey risk mitigation messages. The public may seek additional advice about these measures from trusted people in the community such as longtime residents and former or current local and state officials who live in the community. During this period, it is helpful for agencies to identify information brokers who may have the potential to act as citizen news producers in the next two stages of the crisis.

Information brokers are people who are positioned at the edge of several social networks, thereby bridging unconnected groups and acquiring broad access to information (Burt 2004). In the new communication environment, the information broker who becomes a citizen news producer also has access to new communication media such as global positioning system (GPS)-enabled cell phones or Internet applications for Web sites to produce and distribute information. For example, a community member involved in fire mitigation efforts may be a retired state forest official who also has ties with people in the local utilities and people in the city government. At the pre-crisis stage, the community member may be one who uses brokering skills to reach community solutions for fire mitigation efforts. However, during a crisis, the community member may use available information sources to deliver information directly to the public via the Internet or cell phone networks.

The traditional approach for public information officers in the pre-crisis stage is to develop communication and education campaigns aimed at the general public, and to reach consensus among organizations on proper communication protocols during a crisis. However, for the new communication environment, it will be important to step outside these traditional practices and identify information brokers who have the potential to rapidly deliver information during a crisis that is relevant to the specific place.

Not only will public information officers want to identify potential information brokers, it will also be helpful to develop new partnerships with these brokers to foster trust and respect before a crisis occurs. Having connections with these partners and resources early in the process can help guarantee more inclusion in the network during the crisis. It can help agencies innovate early to reconfigure message delivery for new forms of media if a crisis does occur.

The most difficult challenge during the pre-crisis stage is harnessing and facilitating the potential of emergent nontraditional news sources. It requires re-imagining the scope of public information. During the pre-crisis stage, it is possible to not only conduct educational campaigns for the public, but also educate those who may be involved in the process of citizen news production later on in the crisis. Public information officers in collaboration with community information brokers might discuss the importance of conditional constraints on when, where, and what information can or should be used. Although it is likely only informal agreements can be reached that have no contractual obligation, these discussions can help lay the groundwork so that there is greater understanding of information constraints resulting from the need for quality control when the crisis is underway.

If affected residents find that their information needs cannot be answered through traditional communication channels, information brokers will emerge as citizen news producers to provide information synthesized from a variety of sources.

Initial Event

At this stage, the general public is seeking locally relevant, real-time information on the crisis that is presented in an empathetic and reassuring manner (Reynolds and Seeger 2005). They are also seeking information that helps them take action and provides them with guidance on how and where to get more information.

If affected residents find that their information needs cannot be answered through traditional communication channels, information brokers will emerge as citizen news producers to provide information synthesized from a variety of sources.

If the public information officer has identified potential news producers at the pre-crisis stage, it is possible to exchange information with the emergent news producers and provide some quality control on content through informal agreements. In addition to maintaining relations with emergent news producers, public

information officers can adapt quickly to the evolving communication styles and preferences of the public. This may involve, for example, new uses of media such as text-messaging to communicate evacuation or reentry plans. Once a new communication technology is widely used, it may be used in a crisis to respond rapidly to public information needs.

Maintenance

During the maintenance stage of the crisis, the public is still uncertain about the outcome, so it needs reassurance and guidance in how to take action to reduce the uncertainty and evidence that the agency has listened to communication requests (Reynolds and Seeger 2005). At this stage, it is possible to correct misunderstandings and rumors as well as reiterate how and where the public can get information. If public information officers are well-integrated into the emergent networks of citizen producers, they have the opportunity to correct misunderstandings and rumors that may be inadvertently perpetuated by citizen producers who are responding to public inquiries. If public information officers are not well connected at this stage, they risk having rumors and misunderstandings multiply in the new communication environment.

At this stage, public information officers have the opportunity to build trust and accountability in their relationships with citizen news producers through information sharing. The more connections that public information officers have with nontraditional news producers, the more likely errors can be corrected and a common understanding of information constraints and purposes can be shared.

Resolution

As a crisis is resolved, it is still important to stay engaged in the process and help resolve issues through honest and open discussions about cause, responsibility, and the adequacy of response (Reynolds and Seeger 2005).

Traditionally at this stage, the focus of agencies is to promote their image and positive memories of how the agencies responded to the crisis. However, in the new communication environment, agencies have far less control over how their image will be presented. Therefore, it is important once again for public information officers to err on the side of openness, which emphasizes the need for trust and accountability in relationships with nontraditional news producers who are likely to persist past the crisis. For example, the Web site for Ranger Al continued to post information following the wildfire event, allowing the community to discuss past events and current problems and issues related to restoration efforts.

Evaluation

In this period of reflection, the adequacy of response and communication effectiveness are considered. In an ever-changing new communication environment it is important for public information officers to take the time to analyze what was learned and how to adapt current practices to future crisis events. It is especially helpful to consider how initial efforts during the pre-crisis stage may provide a better foundation for establishing trust and accountability with citizen news producers before the crisis escalates.

Conclusions

The traditional star-configuration communication structure will need to be reconfigured in a manner similar to virtual organizations that form in response to short-term needs.

In this new communication environment, there is an abundance of citizen news producers who emerge during a crisis and only a few who establish credibility with the public. To be successful in the new environment, public information officers will need to identify potential and emerging citizen news producers from existing information brokers and engage them in crisis communication.

The traditional star-configuration communication structure will need to be reconfigured in a manner similar to virtual organizations (VOs) that form in response to short-term needs.

A review of VOs has shown that the synergy of connections in a VO determine VO structure over time (Camarinha-Matos and Afsarmanesh 2003). The most successful governing structures have been lateral and flexible structures that can easily reconfigure (Ahuja and Carley 1999). Virtual organizations initially operate best with informal practices and unwritten codes of conduct that foster interaction and synergistic research. The informal nature of a VO makes it possible for independent entities to coordinate and collaborate. Some of the resources and support that are essential to a communication virtual organization are provided in table 28.

The formation of collaborative networks in a new communication environment will require a departure from the traditional approach of agency information distribution. The virtual breeding environment will need to be flexible and encourage collaborative efforts. Public information officers may benefit from understanding how virtual organizations are emerging in other sectors, such as engineering, to better understand how they might structure an emerging organizational structure in the new communication environment.

Table 28—Key factors in a virtual breeding environment

Trust	It is important to establish a foundation of trust between organizations and individuals so that informal agreements can be reached on information exchange.
Partner selection	The costs associated with having unreliable information partners is high; therefore it is important to invest time and energy in assessing potential partners at the emergence of a collaborative effort.
Commonality of interaction	Shared incident command team infrastructures and protocols help standardize information sharing and help set the foundation for informal agreements on information exchange and constraints.
Dynamic reconfiguration	The emergence of collaborative organizations is often rapid and ephemeral, thereby demanding that the virtual breeding environment have the ability to respond quickly to network formation.

Source: Camarinha-Matos and Afsarmanesh 2006.

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Communication Strategies for Postfire Planning: Lessons Learned From Forest Communities

Eric Toman,[1] Bruce Shindler,[2] and Christine Olsen[3]

Abstract

Agency communication activities following a wildland fire event are an important part of the postfire actions. Results from 78 semistructured interviews conducted with agency personnel and community members at five national forests were analyzed. Each community had been previously affected by large wildfires. Important issues included credibility, trust, addressing uncertainty, and attention to special places. This study concludes with five key ways to contribute to successful communication in postfire environments.

Keywords: Wildland fire, communication, community involvement, postfire planning.

Introduction

Wildfire management has grown increasingly complex in recent years, particularly in the wildland-urban interface (WUI) where steady population growth has resulted in greater risk to people and property. Recent trends suggest the process of recovering from large fires (>100,000 acres) will become increasingly important to forest agencies and communities (National Interagency Fire Center 2007). Indeed, the postfire environment is filled with a high degree of uncertainty and pressure for prompt action. Resource professionals are not only called on to make technical decisions regarding fire management and restoration, but are also expected to communicate current and reliable information and include community members in postfire planning (Taylor et al. 2005, McCool et al. 2006). Not surprisingly, such circumstances can result in considerable conflict over potential management actions. Successful planning efforts will require an informed and supportive constituency. Effective communication strategies to meet the information needs and expectations of local citizens will be at the heart of postfire management.

Resource professionals are also expected to communicate current and reliable information and include community members in postfire planning.

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The purpose of the pilot study described here is to identify federal management units that have recently experienced large wildfires and use these settings to examine the effectiveness of agency-citizen communications. Most of what we know about fire communications comes from research in prefire situations, particularly interactions with citizens about fuel reduction activities and defensible space programs. Our intent here is to learn from both agency personnel and community members specifically about their experiences in postfire circumstances. Essentially, we were interested in the factors that lead to effective communication and that build stronger relationships, but we also wanted to know about the constraints that confronted both groups. Ultimately, we want to provide information to management personnel so they are better prepared to develop their own public outreach approach following a fire event.

Study Sites

We report here a summary of research conducted in 2005 and 2006. Semistructured interviews were conducted with agency personnel and community members at five locations, each of which had been previously affected by large wildfires including the loss of homes at the wildland-urban interface. Study sites included communities adjacent to five national forests (NF).

Rogue River-Siskiyou NF (Oregon)

Communities are diverse, ranging from the cities of Grants Pass, Medford, and Ashland to small dispersed settlements throughout the Applegate Valley and other communities west of the I-5 corridor. The landscape is equally diverse with the rugged slopes of the Siskiyou range, including protected wilderness and more typical WUI forested areas. The major event was the 500,000-acre Biscuit Fire in 2002.

Deschutes NF (Oregon)

Although the cities of Bend and Redmond were affected, the areas most influenced by fires were the city of Sisters and the small neighborhoods and resort communities in the more heavily forested areas to the west. This includes the Metolius Basin, popular among retirees and recreation visitors. A series of fires has hit the area since 2000; the largest was the 90,000-acre B&B Complex Fire in 2003.

Pike-San Isabel NF (Colorado)

Adjacent communities are representative of the Colorado Front Range. Denver is noteworthy because fires threatened the city's public watershed and water supply. Many smaller communities in the WUI to the south and west were hit the hardest by the 138,000-acre Hayman Fire in 2002.

San Bernardino NF (California)

This forest borders the Los Angeles Basin and serves many of its population as a recreation area and as a place for second homes in the WUI. The sites most affected by the Old and Grand Prix Fires (160,000 total acres) in 2003 were the numerous forest and canyon communities on the slopes surrounding the national forest. Other areas substantially affected were the resort and other small communities in upper elevations.

Cleveland NF (California)

This forest is fragmented around numerous small but growing communities typical of the spreading southern California metropolis. Many are bedroom communities for commuters and are tucked away into canyon areas up against the forest boundary. The sites hit hardest by the complex of fires (Paradise, Otay, and Cedar; 375,000 total acres) in 2003 are east of San Diego.

Methods

Both telephone and face-to-face interviews were conducted with 78 individuals. Of these interviewees, 24 were Forest Service personnel and 54 were community members. Participants described their experiences with agency-citizen communications and provided insight into what has worked, what has not, and contextual factors that influence success in postfire settings. The interviews were then coded and analyzed to identify key findings and themes running through responses. We emphasize that this was a pilot study, intended to capture learning experiences from affected individuals. Some statements were unique to certain locations, but many proved to be common across all settings. Although we recognize these findings may not apply everywhere, it is likely they provide examples and ideas that managers can adapt to their own situations.

We report on our conversations with agency personnel and citizens by noting important points and highlighting the words of these individuals to illustrate their interactions. This presentation style serves to focus on our objective of lessons learned. We think this approach is useful to time-strapped managers who often need information in an accessible, easily digestible form. Thus, we present five primary areas of importance, following each with key points reflecting specific ideas as well as interview quotes to further illuminate contextual relevance. Specific quotes are attributed by state (CA, CO, OR) and to the type of respondent (agency or community member). We conclude with a brief summary.

Findings

Five thematic areas from our collective interviews are represented here.

1. Recognize the Complexity of the Communication Situation

Inheriting the aftermath of a 200,000- to 300,000-acre wildfire is likely to be a one-time event for most resource professionals. The ramifications are complex. The media has brought regional or even national prominence to the fire, many homeowners are uncertain about what happens next, special interest and community groups line up on both sides of potential actions, and all decisions seem to be time sensitive. Many managers with whom we spoke recognized this new era of large wildfires.

> The fact is, we learned that judging our actions based on our past experience was not adequate for this set of fires. There's been no experience like this during our lifetimes, or our parents' or grandparents' lifetimes. (CA, agency member)

This level of disturbance to forest systems and surrounding communities puts a premium on organizational competence and support for personnel who find themselves in leadership roles. Our respondents identified a series of ideas that contribute to an agency's ability to operate in this complex communication environment.

Responding agency personnel saw the importance of organizing within their work unit before engaging the community.

Develop an internal plan for community outreach—
Responding agency personnel saw the importance of organizing within their work unit before engaging the community. They recognized the need to plan their communication approach just as with any other management activity; others lamented they had not done so. Employing this strategy allowed agency personnel to first agree on how citizens (property owners, members of interest groups) would be included and how to communicate with them in an organized and effective manner. Managers also saw this as a way to keep the message consistent and the information more accessible to the public. In short, the management team needs to be clear on its own objectives, to consider the community's expectations, and to assess internal resources for accomplishing the outreach job.

> A failure in our communication effectiveness could have been a fatal flaw… We developed protocols to maintain consistency within the agency. (OR, agency member)

> Contradictions can create confusion and unrealistic expectations among the public. (CO, agency personnel)

Have the "right" people in the communication job—
Once a plan is developed, it becomes easier to identify the skills necessary for the communications job. Having the right person in the lead is essential. Both agency and community respondents recognized that the ability to genuinely communicate with the public is a necessary, but often rare, talent. These individuals typically are well informed, able to think on their feet, and comfortable talking to individuals, groups, and the media. Most important is that they have a natural ability to engage people in thoughtful consideration of a problem and also listen to them. Several respondents noted the best person for the job is someone who already has established credibility and trust with local citizens.

Having the right person in the lead is essential.

> The key is finding the right people with the right skills for the position. (OR, agency member)

> If I had it to do over again, I would use existing staff who have connections to the community. (CO, agency member)

> To a large extent, success has been based on personalities. The type of individuals the Forest Service has here makes the difference. (CA, community member)

Several respondents also understood that outreach staff need adequate training. When individuals with no experience were put in lead positions, the entire effort suffered.

> Fire information is seen as a need during the crisis, but the agency doesn't see there is a need to train people for that role. (CA, agency member)

Many recognized communicating with citizens after the fire is out also pays dividends. Giving credence to the outreach job is a way for the entire management unit to offer support to personnel who will organize recovery efforts that include the community.

> More outreach resources could have decreased controversy and increased acceptance. (OR, agency member)

Engage the public about big picture ideas and find common goals—
Many individuals spoke about the need for all parties to think about what is at stake across the forest spectrum and to agree on a few common goals. It is easier to achieve specific objectives through specific treatments if people can agree on the central problems facing them. Agreeing on what a recovered forest should look like (desired future conditions) is a useful step.

> If you want to create unity it is very useful to have a common enemy. The bark beetle was our red flag and our common enemy was the dead trees. (CA, agency member)

> It's no longer about hugging every tree. It's about a healthy forest… A healthy forest is more fire resistant. Now we're all fighting for the same thing. (CA, community member)

After a fire, there are multiple options including restoration for a range of factors, salvage harvest, and leaving the forest to recover on its own. When considered from a landscape perspective, each option may provide a relevant contribution for a recovery plan. The process of reaching agreement on an overarching goal, such as restoring healthy forest conditions to the landscape, will require participants to also discuss the contributions each action can have toward this end.

> We all agree. We don't want it to burn down. This cuts through all the barriers. (CA, community member)

> Everyone agrees on need to reduce density for forest health… We need to talk about what the forest will look like, not the volume cut. (CA, agency member).

Anticipate and target controversial issues (don't avoid them)— Everyone agreed that most postfire plans involve difficult decisions. Both agency and citizen respondents also recognized it was in no one's interest to sugar coat or soft pedal the more controversial ones.

> I hate it when they blur the truth. If this EIS is about economic recovery, don't talk about restoration as the purpose. I think it becomes offensive and it harms the credibility of the agency and the individuals. (OR, community member)

> Sometimes I think we should just be upfront and say this plan is about economic recovery. (OR, agency member)

Management units that target tough issues and get the public involved in discussions early will be seen as proactive and honest.

Management units that target tough issues and get the public involved in discussions early will be seen as proactive and honest. Those who do not, may be viewed as attempting to hide something and can have difficulty gaining the public's trust.

> The Forest Service held the meeting just because they are mandated by law to meet with the public… They already had their minds made up. (OR, community member)

> The administration has directed them to do postfire logging. (OR, community member)

There is no denying national politics are contentious, making both sides bitter. Everyone understood that the salvage issue changes the nature of the discussion, especially in Oregon and Colorado.

> There's often support for everything but salvage. (OR, agency member)

Creating realistic expectations about what is possible within federal guidelines gives the group more open and honest parameters for finding solutions.

Recognize role of emotions and uncertainty—
Many respondents recognized a wildfire affects an entire community of individuals, not just those who have the job of restoring forest conditions.

> It's completely understandable why people are mad. Some of them lost everything. (CA, agency member)

Affected citizens can have a range of emotions, from simple curiosity about the extent of the damage to blaming the agency for forest conditions that are more conducive to wildfire. Acknowledging people's emotions and their uncertainties can be viewed as genuine care and concern for the community.

> We appreciate it when the Forest Service acknowledges uncertainty. (OR, community member)

Thus, it is important to be responsive to public comments and concerns. Providing a means to learn about the severity and extent of the fire as well as the potential management options is a next logical step.

> Key thing is there is a lot less professional, political, and public understanding on what you do after a fire than what you do before a fire. Before a fire, the public generally supports thinning, reducing fire risk, and protecting big trees… After a fire, research, professional understanding, and public opinion are not conclusive. (OR, agency member)

A number of agency respondents noted their own uncertainties, particularly around the salvage issue. They acknowledged few agency guidelines were in place nor were there ways to pay for recovery efforts beyond the Burn Area Emergency Response team's initial activities.

> This postfire situation is a relatively new phenomenon… This is a part of land stewardship we haven't figured out yet. (OR, agency member)

> You've spun an idea to the public and gotten buy-in, then it doesn't happen… It challenges our credibility that we haven't followed through on things. (OR, agency member)

In turn, community members voiced that they felt misled. Thus, several agency members took the approach of "under-promise and over-perform."

2. Communication Is More Than Information Provision

Agency respondents acknowledged they tend to measure communication success by counting products rather than their impact or effectiveness. Conversely, many citizen respondents viewed the agency's communication tactics as a one-way flow of information that ignored their interests and concerns.

> The Forest Service has the public input process down… They just ignore responses. They already had their minds made up. (OR, community member)

There was a real sense from respondents that the old ways of disseminating information are simply not enough. Generally programs that just provide information are not very successful at improving public understanding or changing behavior. There is a growing recognition that citizens listen to and gain understanding through numerous means and these most often occur in the context of personal experiences in their communities. This is particularly true in postfire settings where people have attachments to specific places that have been affected and they want to know the particular details of proposed actions. If agency personnel do not take the time to engage these individuals about management activities, it is unlikely that citizens will understand the dynamics involved or go along with untested plans.

> Using the media is one-way communication; it's not the best way of getting information out. (CA, agency member)

Residents care deeply about their homes, their backyards, and familiar places in their community and nearby forests. They have a stake in what happens there and want agencies to be responsive to their comments and ideas. Thus, projects must be seen as urgent and relevant to community members as well as to the agency. Outreach programs are a way to listen to as well as inform the public and ultimately can build understanding of planning and decision process.

Citizens and agency personnel alike acknowledged the traditional National Environmental Policy Act approach (e.g., scoping activities, written comments about plans) is just not sufficient for postfire planning. Many were in favor of new methods that helped provide real education about problems and gained public acceptance for actions.

> The media just transmits sound bites. We need real education and new methods because traditional approaches are unsuccessful. (OR, community member)

Many management units were trying new ideas to reach out and build understanding. Methods viewed as positive and helpful in gaining better cooperation from communities include:

- Meetings in local communities (even neighborhoods) where they could talk with and listen to residents
- Small workshops with subject experts at the table to answer questions
- Demonstration sites where citizens could see the results of different treatments
- Interactive field trips with personnel to discuss conditions, problems, and options
- Home inspections to offer advice on creating defensible space
- Regular updates on progress to organized groups
- Targeting groups at both ends of the preference spectrum

One idea employed on the Deschutes NF after the B&B Fire generated considerable good will among community residents. Guided field trips to the affected landscape were conducted by personnel on the Sisters District. Following the tours, participants indicated an increased level of understanding and support for fuel treatments and forest restoration activities. Even more striking were responses showing a substantial increase in participant confidence in Forest Service personnel (Shindler et al. 2004). Overwhelmingly, respondents expressed appreciation for the opportunity to observe the fire effects first-hand and interact with agency professionals and discuss management options in a meaningful context.

> Public tours were going before the smoke was out… We gained access to areas that had been closed. It gave us a sense of what was going on and a chance to talk about prior treatments. The availability of key staff was really great. (OR, community member)

Simply, these more interactive approaches provide greater flexibility to incorporate the public's questions, concerns, and ideas into the planning process. Addressing questions together can also get everyone working on the same problem. Citizens need to "see, hear, taste, and feel" the situation first-hand to understand what is being proposed to address adverse conditions.

3. Local Community Groups Can Be Strong Allies in the Communication Process

Numerous agency respondents noted the emergence of local groups who organized around fire issues, including the value of their participation.

> There wasn't enough emphasis on working with the community (groups) before the fire, but afterwards we saw that it was a better way to keep people informed. (CA, agency member)

> On the Deschutes, we don't even think of making choices on the land without input from the public. We find it leads to a better product and we get better support. (OR, agency member)

In several communities, organized groups focused their efforts on rehabilitation projects. This local involvement provided the necessary volunteers to complete large-scale restoration activities that otherwise would have overwhelmed agency personnel. These activities not only resulted in important ecological restoration but also contributed to the emotional recovery of communities by bringing people together. Making progress in postfire settings means resource professionals will need to be as attentive to social factors as they are to ecological concerns. Partnerships with community groups play an important role in these efforts.

Making progress in postfire settings means resource professionals will need to be as attentive to social factors as they are to ecological concerns.

Respondents noted that citizen groups have a different set of abilities for outreach. They have a flexibility to communicate in ways that agencies cannot. Citizens enjoy a peer-to-peer relationship, rather than the government to the public.

> Local focus, local leaders make the difference. (CA, agency personnel)

> I think the answer is the Fire Safe Council [FSC] (organized by citizens in California). There are a lot of people in these communities who don't like government… they are more likely to get involved in activities implemented by the FSC. (CA, agency member)

Local organizations are able to contact people more quickly by tapping into established communication networks like group meetings or phone and e-mail trees. In most cases after a fire, residents are hungry for information and will often turn to relatives, neighbors, or community groups to get the latest updates as well as to air their feelings.

> The FSC has a tremendous network of individuals and ability to motivate people locally and gain their commitment. (CA, agency member)

Agency respondents also noted these groups often comprise people who have the skills to manage volunteers. Many are talented and qualified individuals

who gained their skills from careers in the workplace—business, education, government service—and are motivated to help restore their community and local forests. These groups also now include a growing number of retirees who have the time to organize others in community efforts. This has been most notable in producing community wildfire protection plans for fuel reduction activities around neighborhoods.

> We just don't have the organizational skills and manpower for organizing volunteers, but we do have a lot of people who are willing to work because they live near or recreate in the forest. Fortunately, local groups can do the organizing. (CO, agency member)

Agencies will need to empower community groups to play an active role.

Agencies will need to empower community groups to play an active role. With talented citizens who have a sincere interest in local conditions, many managers recognized it makes sense to enter into partnerships with organized groups. In most cases, everyone is working toward a common goal.

> The bark beetle infestation put all of us on the same side of the fence because it's no longer about keeping every tree. It's about a healthy forest. (CA, agency member)

Community groups also provide a way to communicate examples of success. It was noted that some are organized to promote citizen education and have helped create demonstration sites, whereas others are more focused on protecting neighborhoods and getting homeowners involved in defensible space activities. In any case, examples are set from neighbor to neighbor and the message is carried to others.

> Community cohesiveness is the biggest factor… the fire safe model is useful for bringing communities together. (CA, agency member)

Once agency-group partnerships are formed, another benefit may accrue. Local groups can help mediate between a frustrated general public—or outside special interests—and the agencies who are trying to accomplish projects.

> When the community initiates public meetings there is a lot less agency bashing and it's much more productive. (CA, agency member)

It will be important to recognize that the public's interests usually are in specific locations (e.g., around subdivisions, recreation sites, old growth, or protected areas). Thus, planning at a larger watershed or landscape level may be beyond their initial interest or even their scope to fully grasp. In short, many will find it difficult to organize around projects unless there are recognizable boundaries or there is geographic significance to their efforts.

4. Recognize That Postfire Success is Rooted in Actions Before and During Fires

A number of agency respondents noted the necessity of good community relations prior to a wildfire. They recognized that when the agency, citizens, and business leaders had already built strong relationships they were able to come together more quickly after a fire event. But how well agencies communicated with citizens during the fire also influenced their ability to work effectively within the community.

> No agency has enough manpower or ability to do the job by themselves, so we built relationships out of necessity. (CA, agency member)

During a fire, citizens seek real-time and place-specific information (e.g., Is my home affected? When can I return?). If homeowners cannot get timely information from fire personnel, they will be less likely to trust agency communications afterwards.

Some citizen respondents thought it may be easier to develop alternatives prior to the fire when time allows for greater discussion and evaluation of the options.

> Have discussions ahead of fires…make deals before it hits (regarding salvage) to allow prompt removal. (OR, community member)

However, it is difficult for agencies to predict the level of disturbance that comes with a large fire or to have seamless transitions in planning activities when personnel move on to other locations.

> The prior plan didn't anticipate that 57 percent of the watershed would be hit by catastrophic fire in less than 5 years. (OR, community member)

> The continuity of staff is important… Transfers can decrease trust that has been built. (OR, agency member).

In short, the community's history together influences success. No single event occurs in isolation from other actions, even recovering from large wildfires. How well agency personnel have worked with and included citizens in prefire planning activities will have carryover effects. Some even suggested communication over time is key for reducing the complacency that sets in after the fire is over and people turn their attention to other things. In the end, the long-term quality of those interactions can also help relationships endure mistakes or disagreements.

> I can't imagine not having our history (with these groups). It only comes from doing stuff together. (OR, agency member)

> People here know what we do and what we care about… Some are still asking hard questions, but there is a willingness for things to move forward because they are more trusting of us. (OR, agency member)

5. Use Teachable Moments as an Opportunity to Build Understanding and Bring People Together

Managers often noted the advantage of using real experiences to show people fire conditions instead of just talking to (or at) them. The situation becomes more relevant when people see things for themselves. This reflects on the old idea that in communication, timing is everything. Pay attention to those opportune moments when people are most willing to consider your messages. This might be when the media has warned about the approach of a particularly bad fire year or there has been a fire outbreak in a nearby community.

> I show houses that had defensible space and ones that didn't and I tell them fuel is one leg of the fire triangle we can break… I say "you may be on your own," and that gets them thinking. (CA, community member)

> With the drought and the bark beetle infestation came the realization that we're living in a tinderbox… We changed our primary message to "It's not if, it's when." (CA, agency member)

Demonstration sites are excellent places for such conversations and allow people to see things for themselves. Discussions are likely to erupt around real life stories and personal experiences. People respond better to visual images and ideas they can place in a meaningful context. Such opportunities seemed particularly effective at targeting the full range of citizens.

> If the Forest Service doesn't provide a rationale for decisions, the public will never understand specific treatments. (CA, agency member).

> We spend a lot of time on the ground with diverse groups, not just those who are supportive. (OR, agency member)

Certainly just after a big fire has occurred, the window of opportunity is wide open. The fire has captured the public's attention and it is much easier to capitalize on what people see and learn from the event. It also is a good time to promote increased awareness of what makes for a healthy forest and build support for thinning programs. Most all Forest Service respondents noted an increase in support for thinning programs after a fire.

Just after a big fire has occurred is a good time to promote increased awareness of what makes a healthy forest and build support for thinning programs.

> Residents in Palomar Mountain didn't want to cut down anything… Now they understand fire ecology better and see they have too many trees. Now they embrace removal of dead and even some green trees. (CA, agency member)

> We got the public out there to talk to them (about the fire) and we listened to what they thought about salvage. (OR, agency member)

> Getting people out in the field was an easy way to get community perspectives. This has really benefited us … We get better support when we ask for public input. We recognize the value of tours as a teaching tool. (OR and CA, agency members)

It was also noted that learning experiences are just as important for agency personnel. A number spoke of the need to have a way to share experiences across management units.

> We constantly reinvent the wheel. We've gone through the Panorama Fire, the Old Fire, the Bear Fire; it's the same issues over and over. We can't get through the hoops fast enough because no one remembered the lessons from past fires. (CA, agency member)

Community members recognized this situation as well, and as even more organized groups come forward they will be looking for the Forest Service to provide strong leadership in setting strategies after large fires.

Conclusions

This research helps set the context that surrounds agency communication activities following a fire event. The findings suggest that successful outreach is not only a function of the information provided, but also the method used to provide information and the role that citizens are encouraged to play. We have heard from numerous individuals, all who were directly involved in fires, about just how important issues of credibility, trust, addressing uncertainty, and attention to special places are to citizens. This study provided an opportunity to explore how many of these factors contribute to successful communication in postfire environments.

Metric Equivalents

1 acre = 0.405 hectares

Acknowledgments

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Program Evaluation and Interface Residents Research

A User Needs Assessment for Predictive Services: An Analysis Contrasting Respondents More and Less Familiar With the Program

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Abstract

This paper is based on a user needs assessment. The assessment examines the Predictive Services program, which offers products and services through Web sites, briefings, and e-mails administered through the National Interagency Fire Center (NIFC) and the Geographic Area Coordination Centers (GACCs). The main purpose of Predictive Services is to integrate climate, weather, situation, resource status, and fuels information into products that will enhance the ability of managers to make sound decisions for both short- and long-range strategic planning and resource allocation, and to ensure the safety of firefighting and emergency personnel. The user needs assessment relied upon the perceptions of users and potential users of Predictive Services to assess current products and services.

Keywords: User needs assessment, Predictive Services, degree of familiarity.

Introduction

Needs assessments (Rossi et al. 1999) are a useful form of program evaluation. By gathering information from users of a program, researchers gain key information. Considerations of users and potential users, the intended beneficiaries of a program, should be represented (Rossi et al. 1999). That information can then be used formatively by feeding it back into further program refinement and development (Quinn Patton 1986). It has been argued that evaluation should be a part of every serious risk communication effort (Slovic et al. 1990).

It has been argued that evaluation should be a part of every serious risk communication effort.

As this paper will show, user needs assessments require careful attention to a program's targeted audience. Using the Predictive Services assessment as a case example, I lay out findings based on the overall sample of respondents, and then contrast the needs of individuals more and less familiar with the program. All intended beneficiaries of a program should be involved in the assessment whenever possible, including those less familiar with a program. Differences may uncover important implications during analysis and reporting. Attitudes formed through direct personal experience are likely to be stronger than those formed

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through second-hand information or other means (Oskamp 1991). Furthermore, attitudes formed through means other than direct personal experience may hold less importance, or the attitude may be less salient to the individual. Understanding the salience or importance assigned to the particular attitude is a useful consideration in attitude measurement (Oskamp 1991). Although all prospective users may be involved, those reporting much less personal experience or familiarity ought to be identified and their opinions about a program considered separately.

This paper examines the ratings of users and prospective users of Predictive Services products and services, including a distinction between those more and less familiar with the program. Implications based on varying familiarity are offered.

Methods

The Survey and Procedure

A survey was constructed for posting on a Web service. Contacts received four e-mail messages; the first contained a full explanation of the study's purpose along with a request for participation. The following three e-mail messages were reminders. All messages included a link to the survey site. Questions explored basic sociodemographics, job position, familiarity with products and services, ratings of products and services based on six attributes (easy to understand, accessible, complete, timely, relevant, and accurate rated on 1 to 5, where 1 = strongly disagree and 5 = strongly agree), barriers to use of products and services (a list of 16 potential barriers where respondents checked any that applied), trust and confidence in the information (on a 1 to 5 scale, where 1 = none at all, 3 = some, 5 = a great deal), reliance upon the information to assist in decisionmaking (on the same 1 to 5 scale as trust and confidence), and reliance on sources other than Predictive Services (on a 1 to 5 scale where 1 = not at all true, 3 = somewhat true, and 5 = very true). Other items not of direct application to this paper were included in the survey and can be obtained upon request from the author. The survey had a final response rate of 36.5 percent, with less than 1 percent of the sample (12 individuals) refusing to participate in the study.

Sampling Frame and Respondents

Data were collected from a variety of federal fire-management-related personnel. A sample of e-mail addresses representing users and potential users of Predictive Services products and services was compiled using key contact and snowball sampling approaches. Sources of addresses included the National Predictive Services Group, a list of attendees at fire communication certification training, the National Wildland Fire Management Directory, contacts at various federal

agencies, and online directories, resulting in a list of 2,999 federal contacts. In addition to the selected e-mail addresses, a few individuals responded as "volunteers." Volunteering occurred when initial contacts forwarded the survey link to others within or outside their agency who they felt should complete the survey. Volunteers outside of the federal sector were not included in the final data set. The final sample contained 1,078 respondents (including 63 volunteers or 5.8 percent of the respondents). A comparison of the original sample versus volunteers, and a nonresponse bias check is available from the first author. Both the original sample and volunteer respondents are included in the findings in this paper. A nonresponse bias check revealed that the nonparticipants tended to be unfamiliar with the program or cited a lack of time or a dislike of surveys. In most ways they were similar to the survey respondents.

Results

The majority (69.1 percent) of respondents was male and employed with the USDA Forest Service (53.3 percent). Three forms of Predictive Services products and services were examined regarding familiarity. Briefings offered by Predictive Services were familiar or very familiar to more than one-third of respondents (39.8 percent). Products on the Web were also familiar or very familiar to more than one-third (39.6 percent). E-mails containing current projections and other pertinent information from Predictive Services were somewhat less familiar (22.6 percent familiar or very familiar). These items were averaged to create a familiarity scale ($\alpha = 0.885$, table 29), and then two familiarity groups were created: those least familiar and those most familiar, using the median split of average familiarity with Web products, briefings, and e-mails (median = 3.0). The lower familiarity group (unfamiliars) had 602 members (55.8 percent of respondents, defined as a score of 3.0 or less); the high familiarity group (familiars) had 428 members (39.7 percent, defined as greater than 3.0); 4.5 percent of the sample fell into neither group owing to missing responses on the items defining the two groups.

Table 29—Descriptive statistics and correlations between items used to develop familiarity scale[a]

				Pearson r	
Familiarity with	**Mean**	**SD**	**Number**	**Briefings**	**E-mails**
The Predictive Services products on the Web	3.03	1.422	957	0.863	0.643
The briefings offered by Predictive Services	3.09	1.439	957	—	0.653
The e-mails with current projections/information from Predictive Services	2.40	1.419	957	—	—

[a] Measured on a scale of 1 to 5, where 1 = not at all familiar, 3 = somewhat familiar, 5 = very familiar.

Respondents Within the Familiar and Unfamiliar Groups

To better understand who was more or less familiar with Predictive Services products and services (within the familiars and unfamiliars groups) respondents' primary job functions in their federal agencies were examined. Members of the following categories had a greater percentage in the unfamiliars group: public affairs/information officers (78.6 percent, n = 276), National Weather Service meteorologists (66.0 percent, n = 153), support services (63.0 percent, n = 46), incident management team members (62.0 percent, n = 79), crew supervisors/other suppression personnel (59.0 percent, n = 78), and administration/operations/aviation personnel (56.1 percent, n = 66). The categories having more members in the familiars group included meteorologists outside the National Weather Service (81.8 percent, n = 11), multiagency coordinators (90.9 percent, n = 22), fire behavior/long-term analysts and fire-danger analysts (78.7 percent, n = 47), fire management officers or assistants (69.4 percent, n = 160), fuels specialists (61.0 percent, n = 59), fire researchers (52.4 percent, n = 21), and dispatchers (43.9 percent, n = 41).

Approximately equal numbers of males were in the familiars group (47.9 percent) and the unfamiliars group (52.1 percent), and most females (73.8 percent) were in the unfamiliars group (females were also much more likely to be in the public affairs/information officers, and support services job functions; $\chi^2_{1,\,1020} = 40.704$, $p < 0.001$).

Respondents were most likely to access or obtain information from Predictive Services during fire season (61.1 percent), and during a fire incident (51.2 percent). They were somewhat less likely to access the information and services when a prescribed burn was being planned (30.0 percent) or when a prescribed burn was taking place (27.0 percent). Access during each of these situations was much less for the unfamiliars group than it was for the familiars group (table 30).

Table 30—Situations when Predictive Services information is accessed by familiarity group

Situation	Unfamiliars (n = 602)	Familiars (n = 428)
	Percent	
During a fire incident	36.2	76.9
During fire season	44.7	89.7
When planning a prescribed burn	14.9	54.2
When a prescribed burn is taking place	12.8	49.8
None of the above	40.4	2.1

Ratings of Predictive Services Products and Services

Respondents were asked to rate their agreement or disagreement on six attributes that might be characteristic of Predictive Services products and services. All six attributes were rated higher (meaning that respondents were more likely to agree with these as positive characteristics of Predictive Services) by the familiars (table 31).

Table 31—Ratings of Predictive Services products and services by familiarity group

	Unfamiliars		Familiars		*t*-test		
Attribute	**Mean[a]**	**Number**	**Mean**	**Number**	**df**	**score**	***p***
Easy to understand	2.7	563	4.5	334	830	-21.533	< 0.001
Accessible	3.4	338	4.1	425	683	-11.083	< 0.001
Complete	2.6	573	4.4	352	893	-21.337	< 0.001
Timely	2.7	568	4.4	327	870	-20.286	< 0.001
Relevant	2.7	550	4.5	279	817	-19.760	< 0.001
Accurate	2.6	572	4.3	367	902	-20.937	< 0.001

[a] Rated on a scale from 1 to 5, 1 = strongly disagree, 5 = strongly agree.

A majority (52.1 percent) agreed with the statement that Predictive Services information was easy to understand (M = 3.3, SD = 1.7, n = 944; 11.1 percent marked "don't know" and 1.3 percent did not respond). However, almost one-third disagreed that Predictive Services information was easy to understand. Familiars expressed stronger agreement that Predictive Services information was easy to understand (10.0 percent of familiars assigned ratings of 1 or 2; 75.5 percent assigned ratings of 4 or 5). Average ratings of ease of understanding were significantly different for familiars and unfamiliars, with familiars providing a much higher rating (using t-test with $p < 0.001$, table 31).

Respondents tended to agree that Predictive Services information was accessible (52.0 percent, M = 3.8, SD = 0.9, n = 768; 27.7 percent marked "don't know," and 1.0 percent did not respond). Familiarity with Predictive Services was also associated with a significant difference on this rating. Familiars were more likely to agree that the information was accessible (3.1 percent of familiars assigned ratings of 1 or 2 and 71.7 percent assigned ratings of 4 or 5). Average ratings of accessibility were also significantly different for familiars and unfamiliars, with familiars providing a much higher rating (using t-test with $p < 0.001$, table 31).

A majority (51.4 percent) also agreed that Predictive Services information was complete (M = 3.2, SD = 1.7, n = 971; 8.4 percent marked "don't know," and 1.5 percent did not respond). However, almost one-third disagreed with completeness as characteristic of Predictive Services information. Similar to the other attributes, familiars tended to express more agreement that Predictive Services information

was complete (12.0 percent of unfamiliars assigned ratings of 1 or 2, 66.4 percent assigned ratings of 4 or 5). Average ratings of completeness of information were significantly different for familiars and unfamiliars, with familiars providing a much higher rating (using *t*-test with $p < 0.001$, table 31).

Although a near-majority agreed that Predictive Services information was timely (49.4 percent either agreed or strongly agreed), almost one-third disagreed with this as an attribute ($M = 3.2$, SD = 1.7, n = 940; 11.5 percent marked "don't know," and 1.3 percent did not respond). In other sections of the survey, open-ended responses suggested that other products offered by other agencies are updated in a more timely fashion during fire season. Other comments focused on timeliness suggested that products are updated more frequently during fire season, but outside of fire season they are sometimes quite dated. Overall familiarity with Predictive Services was again associated with a significant difference. Familiars expressed stronger agreement that the information was timely (11.2 percent of familiars assigned ratings of 1 or 2, and 60.2 percent assigned ratings of 4 or 5). Similar to the ratings for other attributes, average ratings of timeliness of information were significantly different for familiars and unfamiliars, with familiars providing a much higher rating (using *t*-test with $p < 0.001$, table 31).

A near-majority agreed that Predictive Services information was relevant (47.6 percent either agreed or strongly agreed), while one-third disagreed with this as an attribute ($M = 3.2$, SD = 1.7, n = 875; 17.6 percent marked "don't know," and 1.2 percent did not respond). Open-ended remarks suggested that some respondents were unclear how the products and services might be used or applied in their setting. Familiars expressed more agreement that the information was relevant (10.8 percent of familiars assigned ratings of 1 or 2, and 54.2 percent assigned ratings of 4 or 5). In keeping with the other ratings, average ratings of relevancy were significantly different for familiars and unfamiliars, with familiars providing a much higher rating (using *t*-test with $p < 0.001$, table 31).

A near-majority agreed (46.5 percent) with the statement that Predictive Services information was accurate ($M = 3.2$, SD = 1.7, n = 984; 7.1 percent marked "don't know," and 1.6 percent did not respond). However, almost one-third disagreed with accuracy as an attribute of Predictive Services information. Overall familiarity with Predictive Services was again associated with a significant difference. Familiars expressed stronger agreement that the information was accurate (12.2 percent of familiars assigned ratings of 1 or 2, and 67.8 percent assigned ratings of 4 or 5). Similar to all of the other attribute ratings, average ratings of accuracy were significantly different for familiars and unfamiliars, with familiars providing a much higher rating (using *t*-test with $p < 0.001$, table 31).

Barriers to Use of Products and Services Among Familiars and Unfamiliars

Sixteen barriers that might prevent use of Predictive Services products and services were examined, and eight of these were significantly different in likelihood of being reported by unfamiliars versus familiars. Unfamiliars were almost three times as likely as familiars to indicate that they had never thought about using the products (table 32). Unfamiliars were four times as likely to report that current management practices don't require the type of information used by Predictive Services when compared to familiars (table 32). Respondents in the unfamiliars group were twice as likely to report that they did not know how to use the products, and that they did not know where to get advice about using the products (table 32). Unfamiliars were also more likely to report that they did not know where to get the technology necessary to use the products, they did not have the money to use the products, and agency directives and guidelines instructed them to use other information (table 32).

Table 32—Barriers to use of products and services by familiarity group

Barrier	Unfamiliars (n = 602)	Familiars (n = 428)	χ^2 (df = 1, 1030)	
	- - - - *Percent* - - - -			
I never thought about it.	36.0	12.4	72.419	$p < 0.001$
Current management practices don't require the types of information used by Predictive Services.	21.1	5.6	47.968	$p < 0.001$
I don't know how to use the products.	19.4	6.8	32.954	$p < 0.001$
I don't know where to get advice about using the products.	12.8	4.0	23.458	$p < 0.001$
I don't know where to get the technology necessary to use the products.	8.0	1.6	19.879	$p < 0.001$
Agency directives and guidelines instruct me to use other products.	2.2	.5	4.991	$p < 0.03$
I don't have the money to use the products.	2.2	.5	4.991	$p < 0.03$
I don't trust the products and services.	1.8	6.3	14.137	$p < 0.001$

The only barrier more likely to be reported by familiars than unfamiliars was "I don't trust the products and services" (table 32). It should be noted, however, that a lack of trust was cited as a barrier to use by few respondents in either group.

There were several barriers that were equally likely to be reported within each group including needing information that is site specific, not having time to use the products and services, and not having the technology they would need to use the products. "I don't think these products support my agency's current practices," "I

am not mandated to use these products," "I don't trust the advice I get about using these products," "I don't trust information generated by multiple agencies," and "I don't want to use these products and services" were equally likely to be reported among familiars and unfamiliars.

Trust and Confidence and Reliance Among Familiars and Unfamiliars

Trust and confidence in Predictive Services information was significantly higher for respondents more familiar with the products and services.

Trust and confidence in Predictive Services information and reliance on the products and services in making important decisions related to their job duties and functions were compared for familiars and unfamiliars. Trust and confidence in Predictive Services information was significantly higher for respondents more familiar with the products and services ($t_{884} = -12.498$, $p < 0.001$; familiars $M = 3.8$ versus unfamiliars at $M = 3.1$). In addition, familiars were significantly more likely to rely on Predictive Services products and services in making important decisions ($t_{1000} = -22.327$, $p < 0.001$; familiars $M = 3.6$ versus unfamiliars at $M = 2.0$). Unfamiliars were more likely to report reliance on other sources of information ($t_{957} = 4.720$, $p < 0.001$; familiars $M = 2.5$ versus unfamiliars at $M = 2.9$).

Discussion

Although all job function types were important to include in the user needs assessment, level of familiarity with Predictive Services products and services was important to consider to accurately interpret reported experiences and opinions. Although both those familiar and unfamiliar with a program can provide valuable insights, taking the general response as indicative of the performance and service of a program may be unwise. Two reasons support this contention. The first of these is that less experienced users of programs and services may have less direct knowledge of the programs being rated and therefore less stability in the attitudes being measured. One way to address this issue is to imbed an additional question with each rating that queries strength of the opinion indicated. By integrating this step into the evaluation process the researcher allows respondents to gauge how strongly they feel about their opinions. However, this can greatly increase the length of a survey. Another approach, used here, is to assume that those less familiar with a program might differ distinctly from those more familiar, and to account for those differences in the analyses. This was a simpler solution in this study.

The other reason for the recommendation of examining a comparison between more and less experienced users is that if there is a distinct difference between the two groups, revealing this difference may be quite helpful in targeting specific user groups. Individuals less familiar with the products and services seemed to suggest

their agency's guidelines do not direct them to use the products and services. In addition, lack of knowledge was more likely to be mentioned as a barrier. Although it is unlikely that Predictive Services would wish to influence agency guidelines regarding information sources, education and training regarding products available and how to apply them may be of particular assistance to this segment of respondents. Knowing how the products may suit their particular needs could increase product use.

The respondents in the familiars group tended to view the products and services more positively on each of the six attributes rated, tended to have greater trust and confidence in the information provided, and were more likely to rely on Predictive Services information. These findings suggest a generally positive assessment of Predictive Services products and services, although ratings also indicate room for improvement. Specifically, although familiars were most likely to agree that each positive attribute was characteristic of Predictive Services, a tenth or more disagreed with statements that it was easy to understand, relevant, timely, complete, and accurate. Completeness and accuracy had the highest proportions of respondents who disagreed. Although completeness may indicate a desire for additional information not currently available or presented to users, accuracy reflects upon information currently presented. Efforts to address concerns about accuracy may include presenting sources of data, assumptions made in analysis, sources of error and confidence intervals, and guidance on addressing uncertainty.

The lowest percentages of familiars assigning ratings of 4 or 5 were found for timeliness and relevance. Open-ended responses suggested concerns about the timing of updates of products, during and outside of fire season (for a complete discussion of open-ended remarks see Winter and Bigler-Cole 2007). As timeliness may affect accuracy in decisionmaking, further exploration of this issue may be in order. Recommendations are more difficult to make concerning relevance. Some improvement in this area may be realized through training where successful applications of Predictive Services information are presented. In other words, more examples on how the information is best used and applied could address relevancy-related concerns. These issues were revealed in open-ended remarks from respondents and may serve as a starting point for addressing product improvements. However, none of the attribute ratings pointed to serious issues of concern.

Managers wishing to apply these findings beyond Predictive Services can learn from the distinctions highlighted between people more and less familiar with a program. Consideration of frequent and infrequent users of natural resource opportunities, those purporting less knowledge and experience with an issue, and those who indicate feeling less informed might be examined separately to identify their

As consumers of research reports, managers might wish to know the experience base of those involved as respondents in information-gathering efforts.

unique concerns and perspectives. As consumers of research reports, managers might wish to know the experience base of those involved as respondents in information-gathering efforts. I would not, however, suggest excluding the less informed and infrequent or nonusers of services. They also have an important story to offer natural resource management. In particular, we should strive to understand the bases of their lesser experience, from the perspective of a public service mission.

Acknowledgments

The author thanks Tom Wordell and the other members of the National Predictive Services Group for their collaboration throughout this project; Heidi Bigler-Cole for her efforts in earlier phases of this assessment; David Olson at PSW for his assistance with survey construction and data collection; and the respondents who took time out of their busy schedules to help us assess their needs related to the Predictive Services program.

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Living at the Wildland-Urban Interface: Views About Wildland Fire and Defensible Space Practices

Christine A. Vogt [1]

Abstract

Over 1,000 homeowners or Forest Service special use cabin permittees in three national forest areas were surveyed about their views on wildland fire and defensible space. Questions addressed their home-buying process, residency length, recreation usage, consideration for defensible space features for structure and lot, and attitude toward and support for defensible space implementation in their local area. Results suggest most homeowners in the three study areas (California, Colorado, and Florida) learn about wildland fire after they move to the area. California homeowners showed high levels of compliance to defensible space efforts. In Colorado and Florida where it was less likely to be required, 20 to 30 percent of homeowners were practicing defensible space. Special use cabin permittees were studied in California and Colorado and showed high levels of support for adopting wildland-urban interface wildland fire mitigation efforts.

Keywords: Wildland-urban interface, wildland fire, defensible space practices.

Introduction

Record population growth and housing development are occurring where private and public lands meet.

Record population growth and housing development are occurring where private and public lands meet (Stewart et al. 2006). These areas, called the wildland-urban interface (WUI) or intermix, are often near metropolitan areas such as San Diego, Los Angeles, Phoenix, Denver, or Tallahassee. Between 1990 and 2000, 60 percent of all new housing units built in the United States were located in the WUI. In many states, housing has grown faster than population, particularly in recreation amenity counties (Johnson 2002, Johnson and Stewart 2001, Reeder and Brown 2005). Driving forces for these housing and population growth rates include (a) an increasing number of households owing to both population growth and changing household and family structures and size (Heimlich and Anderson 2001); (b) increasing demand for low-density housing in suburban, exurban, and rural areas because homeowners prefer rural or small-town settings and larger yards (Vogt and Marans 2003, 2004); (c) land use policies that support extending infrastructure into rural areas, which in turn allows developers to build on forested or agricultural

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lands; and (d) increasing home construction and home purchases near natural resources for convenient recreation access, natural scenery, and a change of lifestyle, particularly for urban retirees and working professionals who can commute or electronically connect to their work (Johnson and Stewart 2005, Kruger and Alexander 2004, Stewart and Stynes 2006). Wildfire is a top concern for many U.S. communities, especially those in the WUI. Understanding these national trends, which directly impact WUI areas, contributes greatly to federal, state, and local resource and public safety agency efforts to protect resources, human lives, and local economies from wildfire-related losses.

This research project was aimed at understanding the views of homeowners in three distinct areas of the United States experiencing many of the trends mentioned. We chose areas with population and housing growth from both year-round homeowners and seasonal homeowners, and WUI areas where annual home occupancy rates had either increased or decreased. Besides understanding residency tenure and plans for residency conversion (e.g., from year-round to seasonal or vice versa), we were interested in homeowners' consideration of wildfire risks in the area and their knowledge about defensible space features as they considered specific homes or lots. Defensible space ordinances and practices are important tools that communities and fire prevention programs use to encourage (or sometimes force) homeowners to practice. Their purpose is to reduce the risk of a wildfire destroying homes, other structures, and natural vegetation in yards and neighborhoods (Bright and Burtz 2006, Monroe et al. 2006, Winter et al. 2006).

Study Areas

Selection of the study areas began by reviewing the national list of communities at risk published by USDA State and Private Forestry in 2001. Additionally, discussions with Pacific Southwest Research Station scientists and examination of census data provided further direction on WUI areas containing significant residential housing of both permanent and seasonal types. Fuel types, forest species, and forest management practices were also considered in the final selection of three sites. These areas were (a) San Bernardino National Forest, California; (b) Grand Mesa, Uncompahgre, and Gunnison National Forests (GMUG), Colorado; and (c) Apalachicola National Forest, Florida. San Bernardino National Forest is near Los Angeles, and the specific area studied included Arrowhead and Big Bear Lake in San Bernardino County; GMUG forests are in southwest Colorado between Grand Junction and Ouray, and the specific area studied included Ouray, Montrose, and

Delta Counties; and Apalachicola National Forest is west of Tallahassee in Florida's panhandle and included Leon, Liberty, and Wakulla Counties. At the California and Florida study sites, the primary federal resource agency was the Forest Service; at the Colorado study site, the Forest Service and Bureau of Land Management jointly managed the public land.

In all three study areas, visits to the local area and working with Forest Service staff and local fire officials enabled the researchers to identify specific WUI areas ripe for study. Homeowner lists were obtained from county or local tax assessors and represented the most current housing stock and mailing addresses (local for year-round homeowners and nonlocal for seasonal homeowners). During planning trips to the California and Colorado study areas, special use cabins with long-term leases with the Forest Service were brought to our attention and became another population of WUI homeowners to study.

Based on property tax records from county offices, 9,388 homes were identified in the WUI study areas with 5,140 (55 percent) classified as year-round households and 4,248 (45 percent) as seasonal households. A sample size of 3,000 households or 1,000 per study site was used, and after invalid addresses were excluded, a sample of 1,512 year-round households and 988 seasonal households were successfully contacted. Additionally, 496 Forest Service special use cabin permittee names and addresses (463 in California and 33 in Colorado) were provided by Forest Service staff. Of the 2,996 questionnaires mailed to valid addresses by using a three-step mail procedure (Dillman 1978), 1,229 WUI homeowners responded. The highest response rate was achieved for special use cabin permittees (49 percent response), followed by 42 percent for year-round homeowners, and 30 percent for seasonal homeowners. A total of 1,179 questionnaires were used in the analysis.

Following focus groups and interviews with local Forest Service managers and staff, homeowner associations, local fire departments, and other interested local groups or individuals (e.g., Red Cross, real estate agents, water councils), an eight-page questionnaire was constructed for the WUI sample, including the three homeowner types. The mailings included the questionnaire, a personalized letter that included a chance in a drawing for a gift certificate, and a business reply envelope. Press releases were sent to local newspapers to increase the awareness of the study, particularly with permanent homeowners who are more likely to read local newspapers. Statistical analysis was intended to identify similarities and differences across homeowner types in a study area (total of eight subsamples), not necessarily how seasonal homeowners across three distinct areas were similar or different.

Description of Samples

Overall, the respondents to the survey were well-educated and a fairly prosperous segment of the population. They tended to be male (range of 43 percent to 79 percent), which may be an artifact of the man's name being the first name listed in property tax records. Household incomes tended to be higher for seasonal households and special use cabin permittees compared to year-round households. Special use permittees in California were more likely to hold graduate school degrees, and year-round householders in Florida were less likely to have attended college. Retirees were prominent in all three study areas with approximately 4 out of 10 respondents being retired (only year-round households in Florida were lower at 33 percent). Between 10 and 15 percent were self-employed across the groups, leaving approximately 40 percent of respondents being employed full- or part-time. California seasonal homeowners or cabin permittees in the study area were predominantly from their own state (97 percent), whereas half of the Colorado seasonal homeowners were from Colorado and 14 percent from California. The seasonal homeowners in Florida were mostly from Florida (59 percent) followed by Georgia (23 percent) and Alabama (9 percent). Respondents were also asked to select the type of urban, suburban, or rural area that they lived in most of their life. California seasonal homeowners (45 percent) and cabin permittees (51 percent) were most likely to have lived in a major city of over 1 million residents. Colorado (37 percent) and Florida (36 percent) year-round residents were most likely to have lived in the country or a very small town for most of their lives. The other groups had lived in a mix of country to city areas.

Available Fire Protection, Fire-Related Health Issues, and Use of Public Land for Recreation

The areas studied provided different levels of fire protection.

The areas studied provided different levels of fire protection. Some respondents lived in communities with fire hydrants and short response times by fire departments, whereas other households had no nearby hydrants and sometimes no water other than residential wells or water stored in rescue trucks, and fire departments that would provide service as best they could. Almost all homeowners in these WUI study areas believed that they lived in an area served by a fire department. For those who believed fire service was available, they were also asked if fire hydrants were located near their home. In California, very few respondents replied that there was no fire service or hydrants. In Colorado, one-third of the year-round and 13 percent of the seasonal households indicated there was service but no hydrants. In Florida, almost half of the homeowners indicated there was service but no hydrants.

A household member suffering from respiratory or breathing problems was fairly common in the households studied. Three out of 10 permanent households in California and Florida included an affected person. The sampling techniques yielded households who clearly lived in the WUI. Over 50 percent of California residents and 50 percent of Florida residents rated themselves being located very close to the national forest boundaries (less than ½ mile away), whereas over 50 percent of Colorado respondents rated themselves being from 1 to 6 miles away from National Forest boundaries. Year-round homeowners in all three study areas (California, 30 percent; Colorado, 24 percent; Florida, 28 percent) were more likely to use the forest daily for recreation compared to seasonal residents. California (33 percent) and Florida (26 percent) year-round residents also had large proportions of homeowners who do not recreate in the forest. California and Colorado special use cabin permittees held a slight edge over seasonal homeowners in their recreation use levels.

Residency Tenure and Plans for Residency Conversion

Respondents were asked when (year) they acquired their residence and how they purchased their home (real estate agent, within family, directly from owner, other). Home acquisition in the WUI studied ranged from recent years (1997-2002) to prior to 1952 or shortly after World War II. Permittees of special use cabins in California and Colorado were more likely to be in the pre-1952 group compared to other homeowner types (table 33). In California, seasonal homeowners were more likely to be recent purchasers compared to year-round homeowners. Over one-third of Florida year-round homeowners had held their residence for 21 to 50 years. These WUI homeowners purchased their homes in a variety of ways. California and Colorado special use cabin permittees were more likely to have the lease and cabin handed down or purchased from within family compared to the other homeowner types (table 34). California and Colorado year-round and seasonal homes were most likely to have been purchased with the help of a real estate agent or sales office. Florida year-round and seasonal homes were most likely purchased directly from the previous owner.

Retirement plans differ by homeowner type. Year-round homeowners in the California, Colorado, and Florida study sites rarely (5 percent) intended to sell their home and move elsewhere for retirement and only slightly more residents were likely to use this year-round home less or part-time (approximately 7 percent) (table 35). The largest segment of year-round homeowners was not yet retired and they were planning to live full-time in their current WUI home. Seasonal homeowners in the three study sites most often planned to continue living in this home on a

Table 33—Length of home ownership in wildland-urban interface settings

Length of ownership	California study area San Bernardino NF			Colorado study area GMUG NF			Florida study area Apalachicola NF	
	Y (n = 119)	S (n = 176)	C (n = 219)	Y (n = 254)	S (n = 66)	C (n = 21)	Y (n = 267)	S (n = 57)
				Percent				
Last 5 years (1997-2002)	19	30	21	35	36	20	23	24
6 to 10 years (1992-1996)	22	12	15	28	18	15	16	24
11 to 20 years (1982-1991)	32	24	20	20	27	15	22	24
21 to 50 years (1952-1981)	27	34	38	15	16	35	37	24
51 years or longer (before 1952)	0	0	6	2	3	15	2	4
Total	100	100	100	100	100	100	100	100

Y is year-round homeowners, S is seasonal homeowners, and C is special use cabin permittees. NF = national forest. GMUG = Grand Mesa, Uncompahgre, and Gunnison National Forests.

Table 34—Means of acquiring home in wildland-urban interface settings

	California study area San Bernardino NF			Colorado study area GMUG NF			Florida study area Apalachicola NF	
	Y	S	C	Y	S	C	Y	S
				Percent				
Property was purchased with the help of a real estate agent or sales office.	74	70	51	60	63	14	34	18
Property was purchased directly from previous owner.	18	17	28	26	26	38	40	56
Another way (mostly buying land and then building).	6	6	2	6	3	5	4	0
Property was handed down or purchased from within the family.	2	7	19	8	8	43	22	26
Total	100	100	100	100	100	100	100	100

Y is year-round homeowners, S is seasonal homeowners, and C is special use cabin permittees. NF = national forest. GMUG = Grand Mesa, Uncompahgre, and Gunnison National Forests.

Table 35—Retirement plans of homeowners in wildland-urban interface settings

	California study area San Bernardino NF			Colorado study area GMUG NF			Florida study area Apalachicola NF	
	Y	S	C	Y	S	C	Y	S
				Percent				
Plan to live in current home full-time for retirement	52	12	4	57	28	0	66	27
Already retired	32	33	27	33	32	35	25	23
Plan to live in current home part-time for retirement	10	44	54	7	33	45	5	43
Plan to sell this home and move away	6	11	15	3	7	20	4	7
Total	100	100	100	100	100	100	100	100

Y is year-round homeowners, S is seasonal homeowners, and C is special use cabin permittees. NF = national forest. GMUG = Grand Mesa, Uncompahgre, and Gunnison National Forests.

part-time basis during retirement. In Colorado and Florida, approximately a quarter of the seasonal homeowners were planning to become year-round residents. Special use cabin permittees were most likely to continue using the cabin part-time during retirement, and 20 percent of Colorado and 15 percent of California permittees planned to sell the cabin when they retire.

Considering Wildfire Risks During Home Purchase

On average, low levels of consideration or thought occurred before the home search began about the possibility of wildland fires affecting the area where homeowners searched for an appropriate lot or home (fig. 6). During the home search process, when a real estate agent or previous homeowner was most likely to be involved, a slightly higher level of consideration of wildland fires occurred. Many more considered or learned about the threat of wildland fires after they moved to the area.

Many more considered or learned about the threat of wildland fires after they moved to the area.

Homeowners were also asked about structure and property features that are promoted by FireWise or required by building codes for reducing risks related to wildland fires. Specifically, they were asked what level of consideration they gave these features when they purchased their house. For California year-round and seasonal homeowners, fire protection, fire hydrants, nonwoodburning heating sources, and nonflammable roof materials were the top four considerations (table 36). For California special use cabin permittees, trees and vegetation cleared near the cabin was the top response. For Colorado year-round and seasonal homeowners, fire protection and nonflammable roof materials were the top two considerations, and Colorado special use cabin permittees rated nonflammable roof materials much higher than the other features. For Florida homeowners, fire protection service was clearly the highest rated consideration.

Defensible Space Practices, Attitudes and Support

As a final method of understanding WUI homeowners and their interests in protecting their home from the threats of wildland fires, homeowners were asked about experiences and support for three fuel management approaches—prescribed burning, mechanical thinning, and defensible space. Because the focus of this paper is on homeowners and their houses, just defensible space results are presented. Defensible space, described to respondents as "homeowners maintaining a fire-safe area consisting of 30 feet around homes that is free of flammable vegetation," was both required of and implemented by a higher proportion of California homeowners than Colorado or Florida homeowners (fig. 7). In California, high levels of compliance with required programs was found among year-round homeowners and special use cabin permittees. In Colorado, few residents felt they were required to

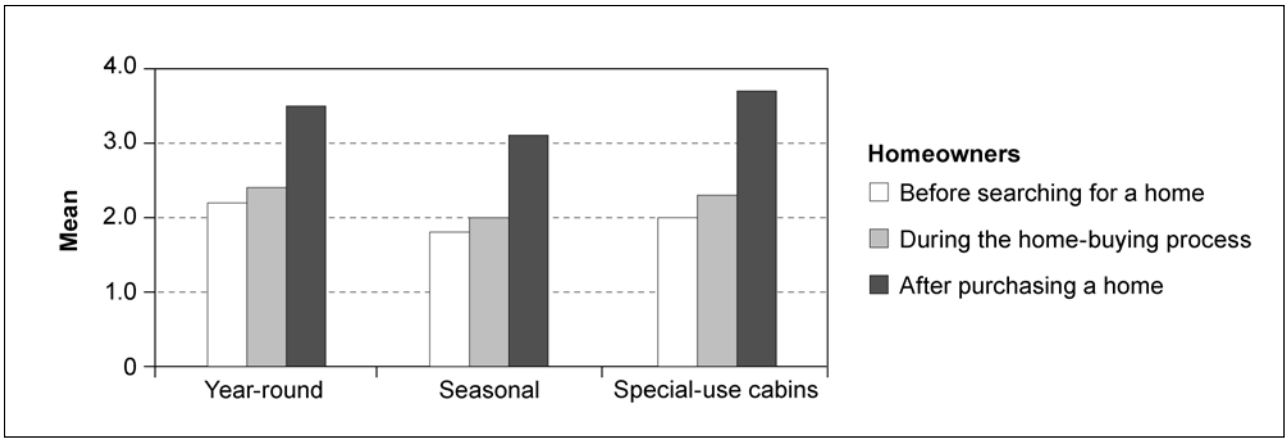

Figure 6a—Homeowners' consideration of wildland fires in the wildland-urban interface during the home-buying process—California study site, San Bernardino National Forest. 0 = not at all considered to 6 = great deal of consideration.

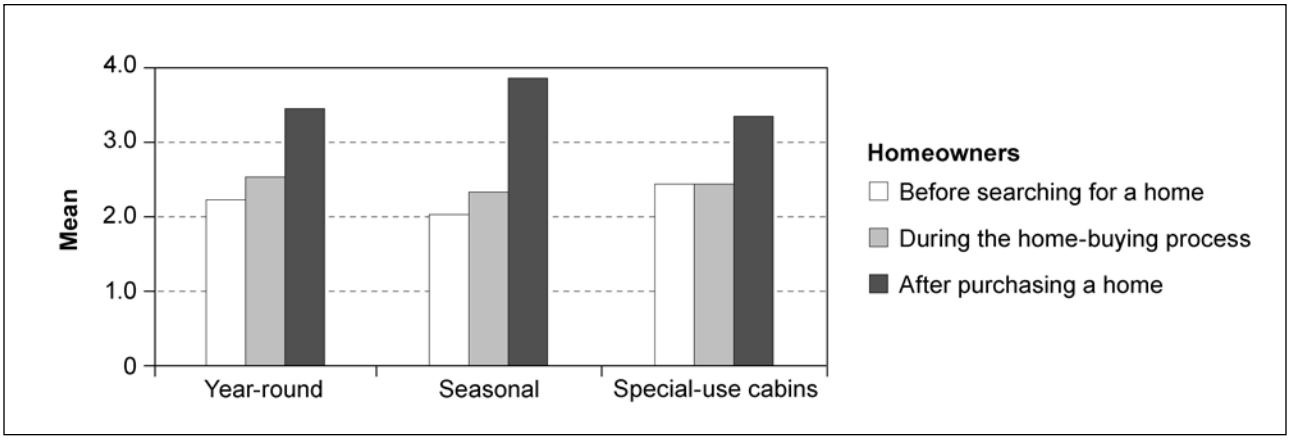

Figure 6b—Homeowners' consideration of wildland fires in the wildland-urban interface during the home buying process—Colorado study area, Grand Mesa, Uncompahgre, and Gunnison National Forests. 0 = not at all considered to 6 = great deal of consideration.

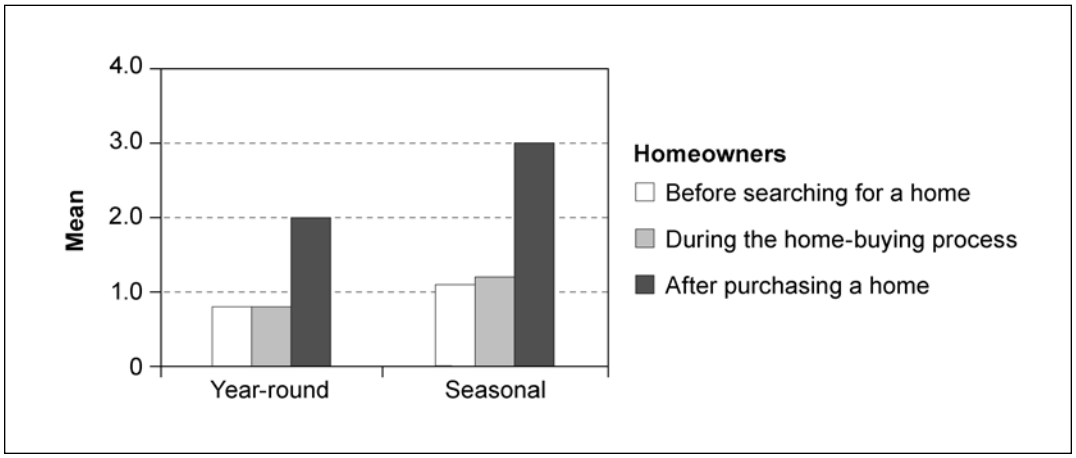

Figure 6c—Homeowners' consideration of wildland fires in the wildland-urban interface during the home buying process—Florida study site, Apalachicola National Forest. 0 = not at all considered to 6 = great deal of consideration.

Table 36—Consideration of structure and property features when house was purchased

Features	California study area San Bernardino NF			Colorado study area GMUG NF			Florida study area Apalachicola NF	
	Y	S	C	Y	S	C	Y	S
					Percent			
Fire protection service (firefighters, fire trucks)	4.5[a]	4.3	3.6	4.0	4.0	2.6	3.7	3.2
Fire hydrants in the neighborhood	4.5	3.9	1.9	3.3	3.2	1.0	2.7	2.1
Heated by source other than wood-burning stove	4.3	4.3	3.0	3.7	3.6	2.6	3.1	2.7
Nonflammable roofing materials	4.3	4.0	3.6	4.1	4.2	4.2	1.9	1.9
Trees/vegetation cleared 30 feet around home	3.7	3.3	3.8	3.8	3.3	3.5	2.6	2.2
Adequate street signs and address labeling for locating home in a fire	3.7	3.5	2.6	3.6	3.0	1.8	3.1	2.7
Wide roads and driveways to facilitate easy access for emergency vehicles	3.6	3.3	3.0	3.8	3.1	2.2	2.5	2.7
Location of home in relation to past fires	2.6	2.3	2.3	2.1	2.0	2.2	1.3	1.2
Lot had relatively few highly flammable trees	2.6	2.5	2.4	2.6	2.0	2.4	1.6	1.6
Exterior propane tank at least 10 feet from home	1.7	2.3	3.3	3.9	3.7	0.9	1.8	2.0
Pipe system that can draw water from lake	1.2	1.6	1.5	1.5	1.3	2.2	1.3	1.3

Y = year-round homeowners; S = seasonal homeowners; and C = special use cabin permittees; NF = national forest; GMUG = Grand Mesa, Uncompahgre, and Gunnison National Forests.

[a] Mean score with a scale where "0" labeled as not at all a consideration to "6" labeled as a very strong consideration.

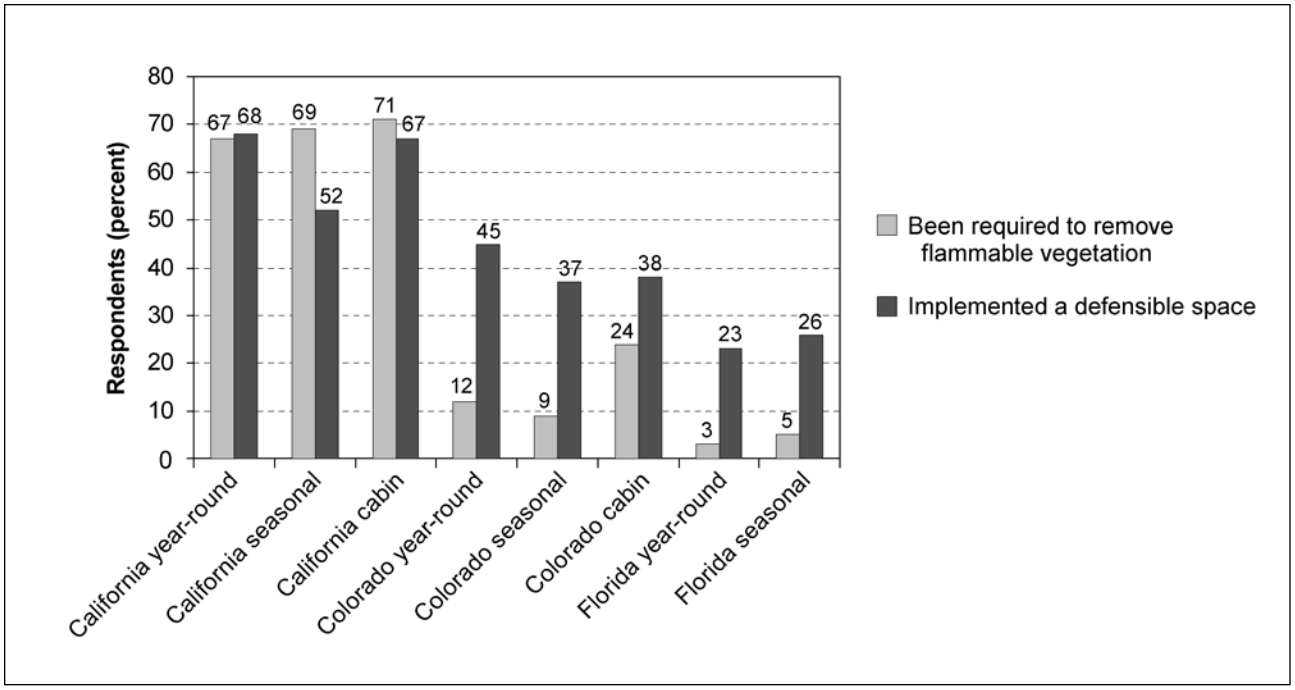

Figure 7—Use of defensible space practices and mandates in Florida (FL), Colorado (CO), and California (CA).

remove flammable vegetation, however, three or four times as many households implemented defensible space on their own. A similar, but lower trend, was found with Florida homeowners.

Attitudes toward and support for the implementation of defensible space was high, and moderately to strongly positively correlated, across all three study sites (table 37). California homeowners held the most positive attitudes and were most supportive of the practices, followed by Colorado and Florida homeowners.

Table 37—Consideration of structure and property features when house was purchased

Features	California study area San Bernardino NF			Colorado study area GMUG NF			Florida study area Apalachicola NF	
	Y	S	C	Y	S	C	Y	S
				Percent				
Attitude[a]	2.2	1.5	2.1	1.7	1.8	1.3	1.4	1.2
Support[b]	1.8	1.4	1.6	1.8	1.9	1.6	1.3	1.2
Pearson correlation—attitude and support	.51**	.36**	.43**	.57**	.70**	.51*	.49**	.48**

Y = year-round homeowners; S = seasonal homeowners; and C = special use cabin permittees. NF = national forest. GMUG = Grand Mesa, Uncompahgre, and Gunnison National Forests.

[a] Mean on a seven-point scale where -3 = extremely negative, 0 = neither, and 3 = extremely positive.

[b] Mean on a seven-point scale where -3 = strongly disapprove, 0 = neither approve/disapprove, and 3 = strongly approve.

** significant at $p < 0.01$.

Management Implications of Research

Public opinion about wildland fires in high-risk WUI areas where year-round and seasonal homeowners and special use cabin permittees both live and recreate is of great importance across much of the United States. This study profiled three ecologically and socially diverse residential areas within much larger national forests or other public land holdings. The homes in these areas ranged from brand new to over 50 years old, and from small in size to mansions. In areas such as these with interface and intermix of flammable vegetation and homes, the local, state, and federal resources to protect homes and lives are stretched. This study illuminates the lack of knowledge of risks or costs associated with the benefits of living next to or in the forest.

California homeowners near Big Bear Lake in the San Bernardino National Forest clearly held the greatest level of involvement in defensible space principles and practices. Most of the California seasonal homeowners and cabin permittees live full-time in other California communities, and thus are likely to experience wildland fire risks at "home" too. The special use cabin permittees were very interesting to study and possibly could serve as role models for the effective defensible

space outreach programs and homeowners' response to the program, particularly for seasonal homeowners who lagged other homeowner types. In the Big Bear Lake area, Forest Service staff monitored and enforced defensible space and targeted education programs to these permitted homeowners. This may be attributed to the Forest Service knowing who lives there and where the house is located. Although these concepts seem standard, keeping track of where houses are located, who lives there, and when they live there is not easy. Forest Service staff had close relationships with Colorado special use permittees compared to the other homeowners. For example, during our site visit, mechanical thinning was underway by Forest Service contractors near the special use cabins (fig. 8).

Figure 8—Mechanical fuel reduction program in a special use permit cabin area, Delta County, Colorado.

In both California and Colorado, public land agencies and local fire departments were making efforts to involve other community groups like water councils, neighborhood associations, or human service nonprofit groups like the Red Cross, to disseminate defensible space initiatives across the community. These types of programs will benefit both year-round and seasonal homeowners, but greater challenges will exist in contacting seasonal residents because they spend less time in

the local area. Furthermore, our research shows that some seasonal homeowners are less willing to spend time or money to implement defensible space and still others prefer the ungroomed, woody lot.

Florida homeowners held some unique perspectives of wildland fire and living in the WUI. Regional differences have been very apparent in wildland fire social science research (see McCaffrey 2006). Although not profiled here, Florida homeowners were more positive toward and supportive of prescribed burning. Apalachicola National Forest implemented a very active burn plan with approximately one-third of the forest acreage burned annually. Florida homeowners, particularly those in less developed neighborhoods, showed weak support for implementing home design or vegetation removal suggesting their independent lifestyle.

This research points to the need for national education programs targeted at people looking to move or purchase a home in the wildland-urban interface.

Finally, this research points to the need for national education programs targeted at people looking to move or purchase a home in the WUI. Forecasts by the Forest Service research team of Stewart, Radeloff, Hammer, and Johnson suggest that the growth of population and homes will continue well into the 21st century. To mitigate some of the pressures in the WUI, home purchasers must be made more aware of the risks, costs, and benefits of living in the WUI. Consumers' demands could begin to change local building codes and ordinances and developers' home site choices and designs. Ultimately, planning and cooperation is needed in WUI areas to build homes more in adherence of FireWise standards and to fund public safety and services.

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Metric Equivalents

1 foot = 0.305 meters
1 mile = 1.609 kilometers

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Trust Research

The Role of Trust, Knowledge, Concern, and Gender in the Prediction of Californians' Reactions to Fire Management[1]

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Abstract

Findings from a statewide survey of California residents were used to predict approval and effectiveness ratings for potential wilderness and wildland fire management techniques that might be used by the Forest Service. The data suggest that self-reported knowledge, concern, and trust in the Forest Service (defined by the Salient Values Similarity model) are helpful in predicting how people perceive controlled burns, closures of partial sites or whole areas, mechanical techniques such as chipping, restrictions on use, and signage in recreation settings. Patterns of trust and distrust derived from a series of studies focused on natural resource management and the literature on risk perception and communications serve as the basis for recommended education and information strategies.

Keywords: Fire management, social trust, concern and knowledge, predicting ratings of interventions.

Introduction

The purposes of the present study were twofold: to improve our understanding of public perceptions of wildland and wilderness fire and fire management techniques, and to explore the applicability of findings from our prior work on the role of social trust in natural resource management.

Social trust is the willingness to rely on those with formal responsibility to develop policies and make decisions. Therefore, it is considered to be a form of social capital, because it reduces transaction costs and facilitates effective management. Organizations that are trusted can work effectively because they do not have to continually explain and defend their policies and actions. They also enjoy political support that is often necessary for obtaining adequate funding.

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Furthermore, their suggestions and policies are more likely to be followed, reducing the costs of inducements to gain compliance. In this case, trust is considered at the macro level, at a larger institutional or group level than interpersonal trust (Bradbury et al. 1999, Hardin 1999). Knowing specific individuals is not required in such cases, given that we could not have sufficient familiarity with an adequate number of individuals within an organization to make judgments of trust (Hardin 1999). Instead, we determine that the general structure, purposes, and actions of an agency or institution are designed to act in our best interest, and in alignment with what we value (Hardin 1999).

We examine trust from the Salient Value Similarity model. Salient values are those that are considered important to a particular situation or issue. Trust results when an individual perceives that their own salient values are similar to an agency's salient values (Cvetkovich and Winter 2003, Earle and Cvetkovich 1995). Similarity is based on perceptions that salient values, goals, views, direction, and thinking are shared.

There is a debate about the degree of trust in governmental agencies and public officials. However, the nature of that debate is not clear. Baldassare's (2000) surveys revealed a tendency for Californians to be less trusting of the federal government than is the general U.S. population. A recent national poll by Dunlap (2000) also suggests that the public has a high level of trust in governmental agencies to solve environmental problems, surpassed only by trust in environmental organizations.

Our research on publics and the Forest Service has revealed a similar trend of high average trust regarding a proposed research program (Cvetkovich et al. 1995), plans for a proposed recreation fee program (Winter et al. 1999), plans to manage a watershed to protect species (Cvetkovich and Winter 1998), and efforts to protect threatened and endangered species and their habitat (Cvetkovich and Winter 2003, Winter and Cvetkovich 2000, Winter and Knap 2001).

Our most recent work has revealed patterns of trust and distrust expressed by focus group participants (Cvetkovich and Winter 2003). Among those who express trust in the Forest Service are those who express perceived similarity to the agency, and who feel that either the agency acts in line with those salient values and goals, or when it does not, that the reasons for the inconsistency between values and actions are valid. A smaller percentage of our study participants have also revealed patterns of distrust in the Forest Service. Some indicate a perceived similarity, but suggest that the agency does not always act in line with those salient values and the inconsistencies have been unwarranted. Finally, there are those who do not perceive similar salient values or goals.

This final group represents a small percentage of our participants, and other researchers suggest a minority of their study participants holds such distrust (Borrie and others 2002). These distrusting individuals represent a great quandary to land managers, nevertheless. Encountering segments of the population, however small, that are apparently unwilling to believe that the Forest Service is acting in "good faith" is a challenge in light of forces encouraging public participation, and engagement is difficult if not impossible with this segment of the population. According to Slovic (1999), distrust can be self-perpetuating and difficult to reduce.

As previously stated, we have found across a number of studies that trust plays a pivotal role in understanding how individuals respond to proposed management actions. In addition, degree of concern about the issue of interest, and selected sociodemographic characteristics, have been found to be significant predictors of ratings on questions about management actions.

Work by Siegrist and Cvetkovich (2000) focused on risk perceptions, suggests that degree of knowledge about an issue interacts with perceptions, social trust, and attitudes about management actions. In their study of college students, trust played a lesser role in understanding respondent perceptions of risk when individuals knew more about the issue of interest. Although their work was with a student population, the premise that degree of knowledge about a natural resource issue will interact with reliance on trust is well founded for the general population.

To continue our research on the role of social trust in natural resource management, we conducted a telephone survey of California residents. Findings from that study are reported here. The work represents an important extension of our queries into social trust because it uses a random sample representative of California residents and because it captures the opinions of the public at large, rather than specific communities of interest or place. Furthermore, its application to the question of wildland and wilderness fire and fire management is both timely and of critical interest to natural resource managers, who must balance the needs of the land with public and political forces, all within an environment of finite resources. Findings are of use in selecting management approaches viewed as "more acceptable" to the public, as well as in revealing knowledge and information gaps. The information on trust reveals forces that may impair or assist communication and education efforts.

Method

Questionnaire

A questionnaire for telephone administration using Computer Assisted Telephone Interviewing (CATI) was developed in both English and Spanish. It was modeled after prior surveys used by the authors and their colleagues that were focused on

attitudes toward threatened and endangered species management (Cvetkovich and Winter 2003, Winter and Knap 2001). Items queried degree of knowledge about fires, concern regarding wildland and wilderness fires in California, salient values similarity (defined as shared goals and values) and trust in the Forest Service to manage forest fires, approval and effectiveness of selected management interventions (such as controlled burns), and sociodemographics.

Procedure

A sample of residential telephone numbers was created, drawn from eight regional divisions in California. The total population for each of the regions in relation to the state population was determined, based on data from the State of California Department of Finance. These regional proportions were then used to create weights for the final data set reported on in this paper.

Respondents were randomly selected to participate in one of two survey forms focused on fire and fire management, or the management of threatened and endangered species. A target of 600 completed surveys per form (n = 1,200) was set to obtain a 95-percent confidence interval, plus or minus 4 percent. Stratification was by region and gender. Assignment to a survey form followed the determination of the following contact criteria: reaching the adult in the household (18 and over) with the most recent birthday, willingness to participate in a phone survey, and gender. Most (90.8 percent) interviews were completed in English and took about 15 minutes to complete. Data from the English and Spanish versions of the survey were analyzed together for this paper. The combined cooperation rate for both forms of the survey was 83.9 percent; 606 respondents completed the fire survey.

Description of Respondents

The majority of respondents (78.9 percent) had lived in the United States all of their lives. Ages of respondents ranged between 18 and 65 years old. About one-third of the respondents were less than 35 years old (32.9 percent), approximately one-fifth were 35 to 44 years old (21.9 percent) and 45 to 54 years old (22 percent). Many of the respondents were well educated; 39.1 percent had completed a Bachelor's equivalent or more. The majority of respondents were White (60.1 percent), although people of color were also represented among the ethnic/racial identities selected. Approximately half (49.5 percent) of the respondents reported engaging in outdoor recreation on a frequent basis (on at least a monthly basis). A majority (73.3 percent) had made at least one visit to a national forest in California in the past 12 months.

Results

Concern and Knowledge About Wildland and Wilderness Fires

Respondents were asked to report how concerned they were about wildland and wilderness fires in the state (on a scale from 1 = not at all concerned to 8 = very concerned). A shared concern over fires was revealed (M = 6.3, SD = 2.0, n = 598). More than two-thirds (69.9 percent) placed their concern at 6, 7, or 8 on the scale.

A shared concern over fires was revealed.

Perceived degree of knowledge was also queried. Respondents were asked to rate their own knowledge about wildland and wilderness fires in the state on a scale from 1 to 8 (1 = not at all knowledgeable, 8 = very knowledgeable). The average knowledge rating was 4.6 (SD = 2.1, n = 597), with slightly more than one-third rating themselves as a 6, 7, or 8 (38.3 percent).

Salient Values Similarity and Trust

Salient values similarity and trust in the Forest Service to manage wildland and wilderness fires were assessed through a series of three items. Salient values were measured by asking about values and goals (table 38). Then the respondent was asked the extent of their overall trust in the Forest Service to manage fires on a scale from 1 to 8 (1 = do not trust the Forest Service at all, 8 = trust the Forest Service completely). Respondents indicated a fairly high degree of trust in the Forest Service to manage forest fires and perceived similar salient values and goals (table 38). Less than one-tenth (5.6 percent) selected 1, 2, or 3 on the trust measure.

A trust scale was created from the mean of the two measures assessing salient values similarity and the single item assessing overall trust in the Forest Service. The scale captured the combination of perceived salient values and trust. This step was based on prior research conducted by the authors and their colleagues (Cvetkovich and Winter 2003, Winter and Cvetkovich 2000, Winter and Knap 2001, Winter et al. 1999); high inter-item correlations paired with a favorable Cronbach's alpha reliability coefficient of 0.78 (table 38).

Table 38—Means, standard deviations, and correlations among trust scale items (n = 489, α = 0.78)

Scale item	Mean	Standard deviation	Trust	Goals
The Forest Service shares your values[a]	6.22	1.95	0.492	0.664
The Forest Service has the same goals[b]	6.09	2.07	.467	—
You trust the Forest Service completely in their efforts to manage forest fires[c]	6.83	1.70	—	—

[a] 1 = "The Forest Service does not share your values"; 8 = "The Forest Service shares your values."
[b] 1 = "The Forest Service has different goals"; 8 = "The Forest Service has the same goals."
[c] 1 = "You do not trust the Forest Service at all;; 8 = "You trust the Forest Service completely."

The Relationship Between Trust, Knowledge, and the Intervention Ratings

Respondents were asked to judge their approval (8 = strongly approve, 1 = strongly disapprove), and the effectiveness (8 = highly effective, 1 = not effective) of six interventions for the management of fires in wildland or wilderness areas. The methods included a range of options focused on recreation or general forest land. We created four combined intervention assessment measures based on factor analysis and satisfactory Cronbach's alphas (factor I: approval and effectiveness of banning some uses and closing some areas, $\alpha = 0.79$; factor II: effectiveness and approval of using information signs and restricting some uses, $\alpha = 0.70$; factor III: effectiveness and approval of mechanical treatments such as chipping, $\alpha = 0.90$; factor IV: effectiveness and approval of controlled burns, $\alpha = 0.82$). For the following analyses, we removed from our data set respondents who had not answered all three items used in the trust scale to improve our scale stability, with a resulting n of 489. Partial correlation coefficients were calculated, first between each of the four interventions as described above, and then controlling for knowledge. A significant bivariate relationship between each intervention and trust was revealed (table 39). Correlations were marginally reduced when controlling for knowledge.

Table 39—Partial correlation coefficients, zero order and controlled for knowledge, trust scale, for four interventions (all correlations are significant at $p < 0.001$)

Item	Trust scale	Chipping	Controlled burns	Bans/closures
Signs/restrictions	0.319	0.305	0.220	0.434
Signs/restrictions[a]	.315	.294	.209	.431
Bans/closures	.288	.278	.160	—
Bans/closures[a]	.285	.273	.155	—
Controlled burns	.198	.190	—	—
Controlled burns[a]	.194	.177	—	—
Chipping	.322	—	—	—
Chipping[a]	.319	—	—	—

[a] Controlled for knowledge.

Predicting Ratings of Interventions

We were interested in the ability to predict the approval and effectiveness ratings of these interventions. We selected gender as an additional independent variable based on our past work, as well as the findings in risk perception (Bord and O'Connor 1997, Gustafson 1998). Other key sociodemographic variables have had lesser impacts in our prior studies and were not focused on in this paper, in part because of limited space (see Winter et al. 1999, Winter and Knap 2001).

Simultaneous linear regressions were estimated for each of the four intervention ratings using concern about wildland and wilderness fires, the trust in Forest Service scale, and gender as predictors. In these four regressions, between 3 and 13 percent of the overall variance in intervention ratings was accounted for by the predictors (table 40). In each case, the trust scale was the most significant contributor to the regression, based on the squared semipartial correlations. Using the same variables in the first regressions, but adding in knowledge as an additional independent variable to observe how knowledge affected the regressions, we estimated the full set again. In two of the four regressions there was a slight increase in the percentage of variance explained, and in two cases there was a decrease when knowledge was added as a predictor (table 40). The expectation, based on Siegrist and Cvetkovich (2000) was that the role of trust would be reduced as a predictor among those with higher levels of knowledge. The variance explained ranged between 4 and 13 percent. Once again, the trust scale was the most significant contributor to each of the four regressions.

Table 40—Simultaneous regressions predicting intervention approval/effectiveness ratings

Intervention	R^2 *adj.*	Gender	Concern	Trust scale	Knowledge
				sr^2	
Chipping/other mechanical	0.121	0.001	0.025***	0.061***	
	.125	.001	.016**	.063***	0.005
Controlled burns	.034	.004	.002	.030***	
	.041	.003	.000	.032***	.008
Bans/closures	.102	.016**	.006	.050***	
	.099	.016**	.006	.050***	.000
Signs/restrictions	.133	.018**	.009*	.066***	
	.132	.020**	.005	.064***	.005

Note: Each row represents a separate regression analysis. The first row predicts an intervention based on gender, concern, and the trust scale, and the second on gender, concern, trust scale, and knowledge..

* = significant at $p < 0.05$; ** = significant at $p < 0.01$; *** = significant at $p < 0.001$;

sr^2 = semipartial correlation coefficient, representing independent contribution of each predictor to the regression.

As an exploratory step we created two subsamples to test the premise that trust would play a larger role in the prediction of attitudes. We took two groups of our respondents, based on level of knowledge about fires, with those rating their knowledge 1, 2, or 3 in the first group (n = 137) indicating low knowledge, and 6 through 8 in the second group (n = 202) indicating high knowledge. We conducted regressions for the four interventions, using these two subsamples. For the low and high knowledge groups we were able to account for between 2 and 17 percent

of the overall variance in intervention ratings based on the independent variables of gender, concern, and trust (table 41). In the majority of cases (six out of these eight regressions), the trust scale contributed the most to the regression equation, as determined by the squared semipartial correlations. The majority of regressions were significant, indicating that the independent variables were useful predictors of respondent's ratings of the interventions. The regressions predicting ratings of mechanical interventions were significant at both high and low levels of knowledge, as were those for ratings of bans/closures, and for signs/restrictions on use. However, the regressions for predicting ratings of controlled burns were not significant, although the ANOVAs had been significant for the full set of respondents.

Table 41—Simultaneous regressions predicting intervention approval/ effectiveness ratings by knowledge level

Intervention	Knowledge level	R^2 *adj.*	Gender	Concern	Trust scale
				sr^2	
Chipping/other mechanical	1 (low)	0.131	0.002	0.006	0.123***
	3 (high)	.080	.001	.031*	.024*
Controlled burns	1 (low)	.032	.000	.001	.045*
	3 (high)	.020	.017	.001	.017
Bans/closures	1 (low)	.089	.032*	.011	.040*
	3 (high)	.091	.004	.000	.080***
Signs/restrictions	1 (low)	.173	.104***	.008	.048*
	3 (high)	.114	.003	.000	.093***

Note: Each row represents a separate regression analysis (based on gender, concern, and the trust scale); the first row is for respondents in the lowest knowledge groups (rated themselves at 1, 2, or 3), and the second row is for the respondents in the highest knowledge groups (rated themselves at 6, 7, or 8).

* = significant at $p < 0.05$; ** = significant at $p < 0.01$; *** = significant at $p < 0.001$;

sr^2 = semipartial correlation coefficient, representing independent contribution of each predictor to the regression.

The amount of variance explained differed by knowledge group, although not always in the expected direction. This finding suggests that level of knowledge is an important consideration in examining the role of social trust in public attitudes and perceptions. However, its actual weight in the relationship is less than expected, and its specific role is somewhat unclear. We cannot conclude that the reliance on trust decreases as level of knowledge increases across various attitudinal objects. Based on findings from Siegriest and Cvetkovich (2000), we would have expected lesser contributions to the regression equation from the trust scale among the higher knowledge group across the four interventions. The results in the final column of the table do not meet that expectation, and further investigation appears needed.

Discussion and Conclusions

Level of concern among our respondents regarding wildland and wilderness fires indicates that most residents are fairly concerned. However, self-ratings of knowledge show greater variability. Trust and values ratings indicate that the respondents we contacted trust the Forest Service in its efforts to manage fires, with those distrusting the agency a small proportion of our sample (5.6 percent).

Social trust has a significant role to play in our understanding of how publics respond to and perceive agency actions.

It appears, based on this study and prior work, that social trust has a significant role to play in our understanding of how publics respond to and perceive agency actions. Additionally, it appears that degree of knowledge about an issue is a consideration in the examination of public responses and perceptions, although its role may vary by the attitudinal object as it did in this study.

Concern about wildland and wilderness fires was not particularly helpful in understanding intervention ratings. Its individual contribution in predicting effectiveness and approval ratings of three out of the four interventions was not statistically significant. The only intervention where concern made a significant contribution was in ratings of chipping or other mechanical methods.

Gender made a significant contribution to the regressions in two of the four interventions, with females being more supportive of bans/closures and signs/restrictions than males. As with knowledge, the role of gender varied by attitudinal object.

We were able to predict a marginal amount of variance for ratings on controlled burns and bans/closures, with trust accounting for the majority of variance accounted for. A larger proportion of variance was explained in the predictions of ratings on chipping/other mechanical means and signs/restrictions, although the percentage of variance remained conservative (below 20 percent), indicating that other factors, not included in the regressions, are responsible for much of the variability in intervention ratings.

It does appear that educational efforts focused on the role of fire in the ecosystem would be advisable. Based on our work, however, we strongly suggest that educational efforts be tailored to variations among the public in levels of trust as well as personal knowledge about fire. Patterns of distrust revealed in recent work (Cvetkovich and Winter 2003) suggest there may be a small percentage of the population who will not find an agency's communications or educational efforts believable. Nevertheless, information and educational efforts, as well as efforts to engage the public in collaborative decisionmaking, remain important. This is because, like other forms of hazard management, effective fire management requires cooperation of a large number of laypeople who must agree to do some things including complying with management actions and restrictions (Slovic et al. 1999).

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Southwesterners' Determinations of Value/Action Consistency, Legitimacy of Inconsistency, and Similar Salient Values

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Abstract

Research demonstrates that trust is an essential component of effective fire management and that there are links between trust and salient values similarity (the public perception that the managing agencies share their values regarding fire management). More recently, we introduced the considerations of action-value consistency and validity of inconsistency as portions of the values-trust relationship. In this paper we explore variables that might lend insight into judgments of salient values similarity. We focus on action-value consistency, validity of inconsistency, opinion about fire suppression, concern about fire, and gender. These variables accounted for a significant portion of the variance in salient values scores, although opinion about fire suppression did not make a significant individual contribution. Findings suggest that public determinations of similar salient values may in fact rest on evaluations of action/value consistency and perceptions of whether or not inconsistencies are legitimate. The lesser role of opinion about fire suppression may be accounted for by efforts to predict general perceptions of shared values from a fairly specific opinion rating. Although a significant portion of variance is accounted for in our efforts at predicting salient values similarity, further work is needed. Specifically, longitudinal studies examining the evolution of perceived shared values and the factors that influence it may be useful.

Keywords: Trust, salient values similarity, action-value inconsistency, legitimacy of inconsistency.

Introduction

This paper examines one aspect of the role of trust in fire management, the determination of salient values similarity made by publics. Past research has demonstrated the importance of trust in effective fire management, and the role that perceptions

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of shared values has in determining degree of trust. We take a unique approach by examining some influences related to perceived shared values, thereby offering a new contribution to the literature on salient values similarity.

Reflecting the emerging recognition that trust plays a central role in fire management, Shindler recently asserted that "...fire managers must approach trust building as the central, long term goal of public communication and outreach (2007: 50)." His assertion echoes results of numerous studies, demonstrating the importance of trust in fire management. For example, Winter et al. (2002) cited trust as a frequently mentioned consideration in public acceptance of fuel treatments. Trust is also significantly associated with perceived risks, benefits, and agency competence (Winter et al. 2004). Vaske et al. (2007) reported social trust in the managing agency was associated with greater support for prescribed burning and mechanical thinning. The predictive value of trust in understanding public acceptability of fire management actions has also been reported by Winter and Cvetkovich (2007) and Winter (2006). Trust has been shown to be essential to understanding willingness to rely on information, as well as likelihood of taking action based on the information (Winter and Bigler-Cole 2006).

Our approach to understanding trust has been through the salient values similarity model. This model suggests that when publics believe that a managing agency shares their values, goals, thoughts, and direction for land management, trust will result. In one study conducted with residents of fire-prone communities, salient values similarity accounted for 47 percent of the variance in trust residents held in the Forest Service to manage fire and fire risk (Winter and Cvetkovich, in press). Another study examined predictors of trust (including salient values similarity, knowledge, ethnic/racial group, concern, gender, and education). A significant amount of the overall variance in trust was explained by these predictors, and the most influential contributor to the regression was similar salient values (Winter and Cvetkovich 2007). Vaske et al. (2007) also found that as salient values similarity increased, so did trust.

However, as Vaske et al. (2007) pointed out, the similarity-of-values issue raises many questions. For example, they suggested that using established measures of values, such as values scales, (in lieu of a general assessment of perceived shared/not shared values) would be important to understanding the trust-values relationship. Some of our more recent work has suggested that residents are influenced by Forest Service actions when considering whether or not the agency shares their values.[3] For example, when discussing values they shared with the Forest Service,

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focus group participants provided examples of thinning efforts to reduce fire risk in their community and how the efforts had affected them. Following an analysis of open-ended comments from focus group discussions, we proposed that considerations of salient values similarity and trust may also involve how often agency actions seem consistent with shared values (action-value consistency) and, when actions did not match, if reasons for inconsistency seemed valid (legitimacy of inconsistency) (Cvetkovich and Winter 2003). This model was expanded through incorporation of items assessing consistency and validity (Cvetkovich and Winter 2007). For example, when a member of the public observed that agency actions were consistent with their values they were likely to trust the Forest Service. Trust was a likely outcome as well when actions were inconsistent with values in cases where inconsistencies were viewed as legitimate. Distrust was the most likely outcome when actions were inconsistent with values and the reasons for inconsistency were not viewed as legitimate.

This paper takes a new approach to the salient values similarity question. To this point, our work has examined predictors of trust, including salient values similarity, action-value consistency and justification of inconsistency, gender, and ethnicity/race. In other pieces we have examined these variables as predictors of perceived acceptability of management interventions. However, given the importance of perceived salient value similarity, we believe it is essential to explore the origins of shared values/lack of shared values. Although this question is a large one beyond the scope of any one paper, we address a portion of determinations of shared values/not shared values. Some evidence from contexts outside of fire suggests that determinations of trust are resistant in the face of agency actions running counter to shared values. This leads us to the main interest of this paper: How do perceptions of action-value consistency and validity of inconsistency influence determinations of shared values?

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Methods

A random sample of residential telephone numbers, drawn from regional divisions in each of three states (Arizona, Colorado, and New Mexico), was used to compile our sample. These states were selected for their wildfire incidence. The total population for each region and state was determined based on data from the U.S. census. Target sample sizes of 400 in each state were set. Sampling was designed for a confidence level of 95 percent, plus or minus 5 percent. A telephone survey of randomly selected residents in each state was conducted.

Procedures

Data were collected in summer 2002 from residents of the three states. Interviewers contacted the adult in the household (age 18 or older) with the most recent birthday, obtained agreement to participate, and then noted if they were male or female (each final set of respondents was targeted to have half males and half females). Cooperation rates were high, ranging between about 87 and 90 percent, differing slightly by state sampled.

A questionnaire for telephone administration (using computer-assisted telephone interviewing) was developed in both English and Spanish. It was adapted from our prior surveys focused on trust in natural resource management (Cvetkovich and Winter 2003, 2007; Winter et al. 1999). A pretest on a randomly selected sample of residents led to minor changes in the introductory statement and to two survey items.

Survey Instrument

Respondents were asked about the following:

- Similarity of salient values with the Forest Service (e.g., To what extent do you believe the Forest Service shares your values about how forest fires should be managed?)
- Sociodemographics
- Concern about fire (How concerned are you about wildland and wilderness fires in [respondent's state of residence]?)
- Knowledge (How knowledgeable are you about wildland and wilderness fires in [respondent's state of residence]?)
- Opinion about fire suppression (selection among three statements: All fires must be extinguished regardless of cost. We probably have to let some fires burn, but must protect residences. Fires must be allowed to take their natural course when burning in wildland or wilderness areas, even if structures are involved.)
- Consistency of agency actions with one's own values (How often is the following true, "The Forest Service makes decisions and takes actions consistent with my values, goals and views"?)
- Validity of any inconsistencies between shared values and agency action (How much do you agree or disagree with the following: "If or when the Forest Service makes decisions or takes actions inconsistent with my values, goals and views the reasons for doing so are valid.")

Additional items covered topics not pertinent to this paper (see Cvetkovich and Winter 2007, and Winter and Cvetkovich 2007).

Respondents

A total of 1,205 respondents participated in the survey. An equal proportion of males (49.9 percent) and females participated. The largest proportions were between ages 35 to 44 (21.9 percent) and 45 to 54 (21.7 percent). Most had completed at least some college (34.7 percent) or reported a bachelor's degree (or equivalent, 18.8 percent). About one-fifth had completed some graduate work (20.7 percent). Three-fourths reported total household incomes of between $25,000 and $74,999.

Results

Salient Values Similarity

Perceived similarity of salient values with the Forest Service (FS) was assessed through three items. Respondents were asked to indicate degree of shared values, goals, and views on a scale from 1 to 8 (where 1 indicated the FS did not share their values, had different goals, and opposed their views, and 8 indicated a sharing of each with the Forest Service). Responses tended toward perceived shared values, goals, and views (table 42). When scores were divided at the midpoint of each scale, 22.5 percent indicated a lack of shared values (assigned ratings of 1, 2, 3, or 4), and 69.6 percent indicated shared values (assigned ratings of 5, 6, 7, or 8; 8.1 percent were not sure or did not provide an answer). Under a similar division, 23.3 percent indicated different goals than the FS, 67.2 percent similar goals (9.4 percent were not sure or did not provide an answer); 20.3 saw their views as opposed by the FS, and 69.4 percent saw their views as supported (10.5 percent were not sure or did not provide an answer). Each of these items was highly correlated with each other (table 42) and was averaged to create the Salient Values Similarity scale (SVS, $\alpha = 0.86$).

Table 42—Pearson correlations between salient values similarity (SVS) items

SVS item	Mean[a]	Standard deviation	Number	Goals	Views
Values	5.92	2.01	1,107	0.67***	0.70***
Goals	5.73	2.12	1,092	—	.66***
Views	5.88	1.98	1,079	—	—

Note: *** = significant at $p < 0.01$.

[a] Values: 1 = "The Forest Service does not share your values," 8 = The Forest Service shares your values;" Goals: 1 = "The Forest Service has different goals," 8 = "The Forest Service has the same goals;" Views: 1 = "The Forest Service opposes your views," 8 = "The Forest Service supports your views."

Analyses that follow examine responses in light of this SVS scale. In some cases, the primary focus is on the division between those who did not believe the FS shared their values (n = 223 or 18.5 percent who had average ratings of 1 through 4.99) and those who shared values with the FS (n = 941 or 78.1 percent had

average ratings of 5.0 and above). This division was based on the midpoint of the scale, rather than the average response of our sample. In other cases we focus on average SVS within the following analyses.

Shared Values and Sociodemographic Differences

A number of sociodemographic characteristics differed between those who believed the FS shared their values and those who did not. Male respondents were significantly more likely than females to believe the FS did not share their values for fire management ($\chi^2_{1\ 1,164} = 24.40$, $p < 0.01$). Although the male and female respondents were similarly distributed across age groups ($\chi^2_{2\ 1,203} = 4.43$, $p > 0.05$), environmental group membership ($\chi^2_{2\ 1,205} = 0.74$, $p > 0.05$), and ethnic/racial groups ($\chi^2_{5\ 1,167} = 10.07$, $p = 0.07$), they were significantly different in education ($\chi^2_{2\ 1,201} = 6.64$, $p < 0.05$) with males more often reporting some graduate education. Males also tended to report higher income levels ($\chi^2_{2\ 1,041} = 14.20$, $p = 0.01$).

Aside from gender, we examined age, education, income, and environmental group membership by shared values/not shared values. No significant difference was found by age group ($\chi^2_{2\ 1,162} = 5.74$, $p > 0.05$), or education level ($\chi^2_{2\ 1,160} = 5.79$, $p > 0.05$). However, respondents at the lowest income level were more likely, and those with the midrange of income less likely, to be among those in the shared values group ($\chi^2_{2\ 1,016} = 11.41$, $p < 0.05$, at the highest income level differences were not significant). Finally, although environmental group membership was rare among our respondents, environmental group membership was twice as likely among those not sharing FS values as among those sharing FS values for fire management ($\chi^2_{2\ 1,164} = 8.10$, $p < 0.01$).

Concern About Fire and Self-Evaluated Knowledge About Fire

Respondents were asked to indicate how concerned they were about wildland and wilderness fires in their state, using a scale from 1 to 8 (1 = not at all concerned, 8 = very concerned). Most (82.6 percent) indicated that their concern was high (6, 7, or 8). Average concern was above the midrange of the scale ($M = 6.88$, SD = 1.62, n = 1,200). Respondents who did not believe the FS shared their values were less concerned about fire than those who perceived shared values ($M = 6.31$, SD = 2.03, n = 223 versus $M = 7.01$, SD = 1.49, n = 939; $t_{280} = -4.83$, $p < 0.01$).

Average self-evaluated knowledge of fire management was also above the midrange on the scale (using the scale from 1 to 8, 1 = not at all knowledgeable, 8 = very knowledgeable; $M = 5.58$, SD = 1.83 n = 1,191). A majority (55.5 percent) rated their knowledge about fire as high (6, 7, or 8). Self-assessed knowledge was

similar for the groups sharing and not sharing fire management values with the FS (M = 5.66, SD = 1.79, n = 934 versus M = 5.39, SD = 1.94, n = 220; t_{313} = 1.88, $p >$ 0.05).

Opinion About Fire Suppression

Respondents' opinions about fire suppression were examined through presentation of three statements. Respondents chose between the statements, selecting the one that best represented their opinion. Differences between the shared/not shared values groups were significant ($\chi^2_{\ 2\ 1,132}$ = 33.90, $p < 0.01$). Although there was no difference between the two groups in agreement with "we probably have to let some fires burn, but must protect residences" (shared = 67.5 percent, not shared = 64.3 percent), agreement with "all fires must be extinguished regardless of cost" was more likely among those who shared FS values (26.1 percent versus 17.4 percent for not shared). Agreement with "fires must be allowed to take their natural course when burning in wildland or wilderness areas, even if structures are involved" was higher among the not shared values group (shared = 6.4 percent versus not shared = 18.3 percent).

In summary, a majority agree that residences must be protected from wildfire. Compared to those not perceiving shared salient values with the FS, a greater number of those who perceived value similarity agreed with statements advocating aggressive fire suppression and low concern about the costs of fire suppression.

Action-Value Consistency

Respondents were asked to indicate how often the FS takes actions that are consistent with the respondents' own values about fire and fire management. A majority (65.2 percent) indicated that the FS generally acted in ways consistent with their values (chose ratings of 1 = always, 2 = almost always, or 3 = usually). Almost a third (30.0 percent) felt the FS generally acted in ways inconsistent with their values (chose ratings of 4 = sometimes, 5 = rarely, or 6 = never). Those who believed the FS generally acted in ways consistent with their values (n = 776) tended to have much higher SVS scores (M = 6.5) than those who did not believe FS actions were consistent with their values (M = 4.3, n = 350, t_{509} = 19.16, $p < 0.01$).

Perceived Validity of Inconsistencies

An additional consideration in determinations of salient value similarity may be whether or not actions inconsistent with values seemed legitimate. Therefore, respondents were asked to indicate "if or when the FS makes decisions or takes actions inconsistent with my values, goals, and views, the reasons for doing so are

valid." The majority believed that inconsistencies were legitimate (79.8 percent chose 3 = neither agree nor disagree, 4 = agree, or 5 = completely agree), although about an eighth felt inconsistencies were not legitimate (15.9 percent chose ratings of 2 = disagree, or 1 = completely disagree).

Among respondents believing that FS actions were consistent with their values, believing that inconsistent actions were legitimate was associated with higher SVS scores (M = 6.6, n = 703) than when inconsistencies were not legitimate (M = 5.7, n = 48, t_{749} = -4.08, $p < 0.01$). For those who generally believed that FS actions were inconsistent with their values, perceived validity of inconsistencies also mattered. Those who believed inconsistencies were legitimate tended to have higher SVS scores (M = 4.90, n = 206) than those who believed inconsistencies were not legitimate (M = 3.6, n = 138, t_{277} = -6.79, $p < 0.01$).

Patterns of Action-Value Consistency, Validity of Inconsistency, and Shared Values

To reflect further on the patterns of consistency, justification, and shared values, we mapped out the number of respondents who fell into each cell combination for these variables (table 43). Although more respondents perceived FS actions to be consistent with their values than not, about a third believed FS actions were not consistent with their values.

Table 43—Variation in salient values similarity by action-value consistency and justification of inconsistency

Forest Service actions consistent?		Inconsistency justified?		Forest Service shares values?	
Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Yes: 786	65.3	Yes: 710	58.9	Yes: 668	55.4
				No: 35	2.9
		No: 50	4.1	Yes: 42	3.5
				No: 6	< 1.0
No: 362	30.0	Yes: 215	17.8	Yes: 128	10.6
				No: 78	6.5
		No: 140	11.6	Yes: 50	4.1
				No: 88	7.3
Missing: 57	4.7	Missing: 90	7.5	Missing: 110	9.1

Among those who believed that the FS' actions were consistent with their values, there were those who believed that when/if the agency behaved in ways inconsistent with their values, the inconsistency was justified. More of the respondents who indicated shared values also indicated that inconsistencies were justified. Among these respondents (inconsistencies justified), it was more likely that

they indicated shared values, than not shared values (55.4 percent of respondents were in this group). Only 2.9 percent of respondents who indicated action-value consistency and justification chose not shared values. Another set of respondents indicated action-value consistency, but felt inconsistency when/if it occurred might be unjustified; most of them also indicated shared values with the FS.

About a third of the respondents indicated that FS actions were not consistent with their values. When those inconsistencies were justified, the more likely choice was shared values, although a lack of shared values was indicated by 6.5 percent of respondents. Finally, there were those who indicated that FS actions were not consistent with their values and a lack of justification of inconsistency (about a tenth of the respondents). Here the more likely choice was a lack of shared values.

Predicting SVS Score

The ability to predict SVS score was examined through simultaneous linear regression. Environmental group membership was excluded from consideration as a predictor because of the low number of respondents reporting memberships. Predictors that were chosen included action-value consistency, justification of inconsistency, concern about wildland and wilderness fires, general opinion on fire management, and gender. Using these predictors we accounted for 49 percent of the variance in SVS scores (R^2 adj. = 0.49, $F_{5\ 1052} = 198.63$, $p < 0.01$). The most influential contributors to the regression equation included action-value consistency, justification of inconsistency, concern, and gender (table 44). General opinion on forest fire management did not make a significant contribution when considered with the other variables.

Table 44—Regression to predict salient values similarity

Predictor[a]	B	ß	*t*	*p*
Action/value consistency	-0.79	-0.53	-20.20	<0.01
Inconsistency legitimate	.42	.05	7.87	< .01
Concern about fire	.14	.13	5.49	< .01
Gender	.28	.08	3.51	< .01
Opinion on fire	-.94	-.01	-.56	.57

[a] Action-value inconsistency: How often is the following true: "The Forest Service makes decisions and takes actions consistent with my values, goals, and views" (on a 1 to 6 scale where 1 = always, and 6 = never); inconsistency legitimate: How much do you agree or disagree with the following: "If or when the Forest Service makes decisions or takes actions inconsistent with my values, goals, and view, the reasons for doing so are valid" (on a 1 to 5 scale, where 1 = completely disagree, and 5 = completely agree); concern about fire: "How concerned are you about wildland and wilderness fires in (your state)?" (on a 1 to 8 scale, where 1 = not at all concerned, and 8 = very concerned); opinion on fire was measured by selecting one of three statements most agreed with: "All fires have to be extinguished regardless of cost," "We probably have to let some fires burn, but must protect residences," or "Fires must be allowed to take their natural course when burning in wildland or wilderness areas, even if structures are involved."

Discussion

The role of salient values similarity in determinations of trust has been well documented. To further understand how salient values similarity judgments are influenced by action-value consistency and validity of inconsistency, we examined survey results from residents in three Southwestern states. Findings suggest that gender remains an important contributor to understanding perceived similar values, although its role in comparison to other contributors suggests it is not the sole or the most important determinant. Because we have examined gender in detail elsewhere (Winter and Cvetkovich 2007), we will focus here on how judgments of similar values are influenced by perceptions of consistency of Forest Service actions with respondents' own values and perceptions of the validity of inconsistency. Results from our analyses indicate that the consideration of agency actions is related to perceptions of whether or not an agency holds values similar to those of the individual. Additionally, in tandem with that consistency/inconsistency determination is the evaluation of whether or not inconsistency in actions seems legitimate. The texture of these two variables shows that shared values judgments might be resilient to action-value inconsistency when reasons can be found for that inconsistent action. Analyses permitted a greater exploration of the likely outcome (shared values/not shared values) in light of various combinations of consistency and validity of inconsistency. Findings demonstrate that a lack of shared values might not always be the case when actions seem inconsistent with values. In fact, some found inconsistent action and a lack of validity, and still believed values were shared. Although an unlikely outcome, these variants are of particular interest to us. Alternatively, it may very well be that when individuals determine that they share values with the Forest Service, actions are more likely to be perceived as consistent and inconsistencies more likely to be viewed as legitimate. More recent efforts have examined focus group participants' reports on why they believe the agency shares their values, to begin to understand causes behind determinations of salient values (see footnote 3).

A lack of shared values might not always be the case when actions seem inconsistent with values.

The role of opinion about fire management (essentially a value measure) showed a significant univariate relationship with salient values similarity, but was not significant in the regression. Even though there were group differences in frequency of acceptance of aggressive fire suppression and disregard of costs, these opinions were a minority in both groups. Therefore, the values of aggressive fire suppression and disregard of costs cannot account for differences in salient values similarity.

Further efforts to understand actual value judgments may be worthwhile as suggested by Vaske et al. (2007). One of their suggestions is to test different values measures in conjunction with perceptions of management actions. We

would propose that beyond an assessment of respondent values in greater depth, an examination of detailed perceptions of FS agency values that mirror evaluations of respondent values would be important in future research. In addition, examinations of value judgments and influences over time would be of great value in understanding factors that carry the most weight in making judgments of similar salient values. It may be that some influences are essentially out of the reach of the managing agency (as asserted by Kumagai cited in Daniel 2007), yet blame is ascribed to the agency, thereby undermining trust and perceived shared values. However, there may be other factors that would be revealed in such an examination that would be quite useful to fire managers striving to maintain positive working relationships with publics.

The need for longitudinal studies that examine the development and evolution of perceived shared values and the factors that diminish and enhance the degree of shared values has become clear. It is ultimately problematic to attempt to understand the origins of perceived shared values without such work. In addition, quasi-experimental approaches would allow testing of various agency collaboration and communication strategies that are effective in enhancing perceived shared values.

Findings affirm the importance of perceptions of consistency between values and actions and the justifications for inconsistencies. As in other papers, we again suggest that when a fire management agency must take actions seemingly inconsistent with its core values and mission, or values that the public is known to place in high regard, reasons for those actions must be clearly communicated.

Findings affirm the importance of perceptions of consistency between values and actions and the justifications for inconsistencies.

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Salient Value Similarity, Social Trust, and Attitudes Toward Wildland Fire Management Strategies[1]

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Abstract

We predicted that social trust in the U.S. Department of Agriculture Forest Service would mediate the relationship between shared value similarity (SVS) and attitudes toward prescribed burning and mechanical thinning. Data were obtained from a mail survey (n = 532) of rural Colorado residents living in the wildland-urban interface. A structural equation analysis was used to assess the mediation role of social trust. Results indicated that respondents shared the same values as Forest Service managers and trusted the agency to use prescribed burning and mechanical thinning effectively. As hypothesized, social trust fully mediated the relationship between salient value similarity and attitudes toward prescribed burning and mechanical thinning. As salient value similarity increased, social trust in the agency increased. As social trust increased, approval of prescribed burning and mechanical thinning increased. These findings reinforce the role of social trust in gaining public support for wildfire management and support prior SVS research suggesting that trust mediates the relationship between value similarity and attitudes.

Keywords: Salient value similarity, trust, attitudes, wildland fire management.

Introduction

Recent severe wildland fires in the United States have heightened awareness of the potential risks associated with wildfires (Nelson et al. 2004, Winter et al. 2002). To minimize the negative consequences of wildfires, the U.S. Department of Agriculture Forest Service has shifted from a traditional emphasis on total fire suppression to policies designed to reduce the probability/severity of wildfires and to restore

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ecological conditions. Two major techniques used are prescribed burning and mechanical thinning. Prescribed burning involves the controlled use of fire to burn off excess vegetation in the forest. Mechanical thinning reduces the amount of vegetation in the forest by physically removing some trees and shrubs. Fire management crews use heavy equipment (e.g., bulldozers) and/or light equipment (e.g., chainsaws). With either prescribed burning or mechanical thinning, management objectives are to (1) reduce the severity of a fire and (2) improve the ability to control a wildfire (USDA 2004).

Although this policy change has potential ecological advantages, a successful fire mitigation program requires public support for management strategies (Cortner et al. 1984, Knotek 2006, Loomis et al. 2001, Taylor and Mutch 1986). Past research suggests that support for prescribed burning and mechanical thinning can differ by (1) demographics (e.g., age, education), (2) situational characteristics (e.g., proximity to a forest) and (3) psychological variables (e.g., beliefs and attitudes toward a management action or the managing agency) (Absher and Vaske 2007). Education, for example, may be linked to knowledge about agency-initiated wildland fire management actions (Vogt et al. 2005). Situational factors define a given context and influence what the public believes is acceptable or feasible (Bright et al. 2007; Kneeshaw et al. 2004a, 2004b). Public support for fire management has been linked to whether the fire will affect private homes built in the wildland-urban interface (WUI) (Davis 1990, Jacobson et al. 2001, Manfredo et al. 1990).

Studies of wildland fire beliefs and attitudes suggest that psychological variables are also important to understanding wildland fire policy support (Absher et al. 2006, Brenkert et al. 2005, Vogt et al. 2005, Winter 2003). The public often under- or over-estimates wildfire risks (Beebe and Omi 1993) and large attitudinal differences sometimes exist between experts and nonexperts in risk situations (Zaksek and Arvai 2004). Other research suggests that public expectations and understandings of wildland fire management in the WUI change over time and need to be affected by well-crafted public education programs (Cortner et al. 1990). McCaffrey (2004), however, concluded that such educational campaigns do not seem to be working, perhaps because of a lack of understanding or trust.

Trust in the agency has been suggested as a key psychological predictor of public acceptability of management actions. Using salient value similarity (SVS) measures, for example, Winter and associates (Cvetkovich and Winter 2007, Winter et al. 2004) examined the direct link between shared values and social trust in the management agency. Social trust is "the willingness to rely on those who have the responsibility for making decisions and taking actions related to the management of technology, the environment, medicine, or other realms of public health and safety"

(Siegrist et al. 2000: 354). The adjective "social" emphasizes that the people being trusted are those with formal responsibilities within organizations that may not be personally known to the person making the trust attribution (Siegrist et al. 2000). In this paper, we attempt to build on this work by developing a conceptual model for understanding the relationships among shared values, social trust and attitudes toward prescribed burning and mechanical thinning.

Conceptual Model

Researchers suggest that social trust is based on perceived similarity rather than carefully reasoned attributions of trust or direct knowledge of the managing agency (Earle and Cvetkovich 1995; Siegrist et al. 2000, 2001). People base their trust judgments on whether they feel that the agency shares similar goals, thoughts, values, and opinions. This approach is known as SVS, but has also been referred to as salient similarity, perceived shared values, and perceived similarity (e.g., Cvetkovich and Winter 2003, Earle 2004, Needham and Vaske 2008, Siegrist et al. 2001).

Perceived similarity frequently predicts social trust; people who perceive that they share similar views with the managing agency tend to trust the agency more than those who do not (e.g., Cvetkovich and Winter 2003, Poortinga and Pidgeon 2003, Siegrist et al. 2000, Walls et al. 2004). Cvetkovich and Winter (2003), for example, found that trust ratings of the Forest Service fire management policies (1) differed significantly by state (i.e., Arizona, California, Colorado, New Mexico), (2) were primarily influenced by values shared between the agency and the public, and (3) predicted respondents' approval of management actions. Winter et al. (2004) found significant relationships between social trust in Forest Service fuel management strategies and perceived agency competence (i.e., an alternative measure of shared values). Winter et al. (1999) conceptualized social trust similar to Cvetkovich and Winter (2007) and found that trust predicted attitudes toward willingness to pay national forest recreation user fees.

People who trust agencies in charge of managing a potential hazard (e.g., prescribed burning) perceive less risk regarding the hazard compared to those who do not (e.g., Bord and O'Connor 1992; Flynn et al. 1992; Pijawka and Mushkatel 1991; Seigrist and Cvetkovich 2000; Siegrist et al. 2000, 2001). Examination of the strength of relationship between social trust and perceived risk, however, has provided mixed results. In some studies, up to 70 percent of the variance in perceived risk is explained by trust (Flynn et al. 1992, Siegrist et al. 2000). Other studies, however, report that 5 to 20 percent of the attitude (i.e., perceived risk) is explained by social trust (e.g., Sjöberg 2000b, Trumbo and McComas 2003, Viklund 2003). Weak to moderate relationships between trust and risk may suggest that people

Examination of the strength of relationship between social trust and perceived risk has provided mixed results.

believe that there are clear limits to how much agencies and other experts know. People may trust a managing agency, but feel that potential risks (e.g., the ability to contain a prescribed burn) are beyond agency control (Sjöberg 2001).

Hypotheses

Based on previous research (e.g., Siegrist et al. 2000, Cvetkovich and Winter 2007, Winter et al. 2004), we predicted that trust will mediate the relationship between SVS and attitudes toward prescribed burning and mechanical thinning. Figure 9 diagrams the predicted relationships. Stated more formally, we hypothesize:

H_1 Social trust will mediate the relationship between SVS and attitudes toward prescribed burning and mechanical thinning.

H_2 As salient value similarity increases, social trust in the agency will increase.

H_3 As social trust increases, approval of prescribed burning will increase.

H_4 As social trust increases, approval of mechanical thinning will increase.

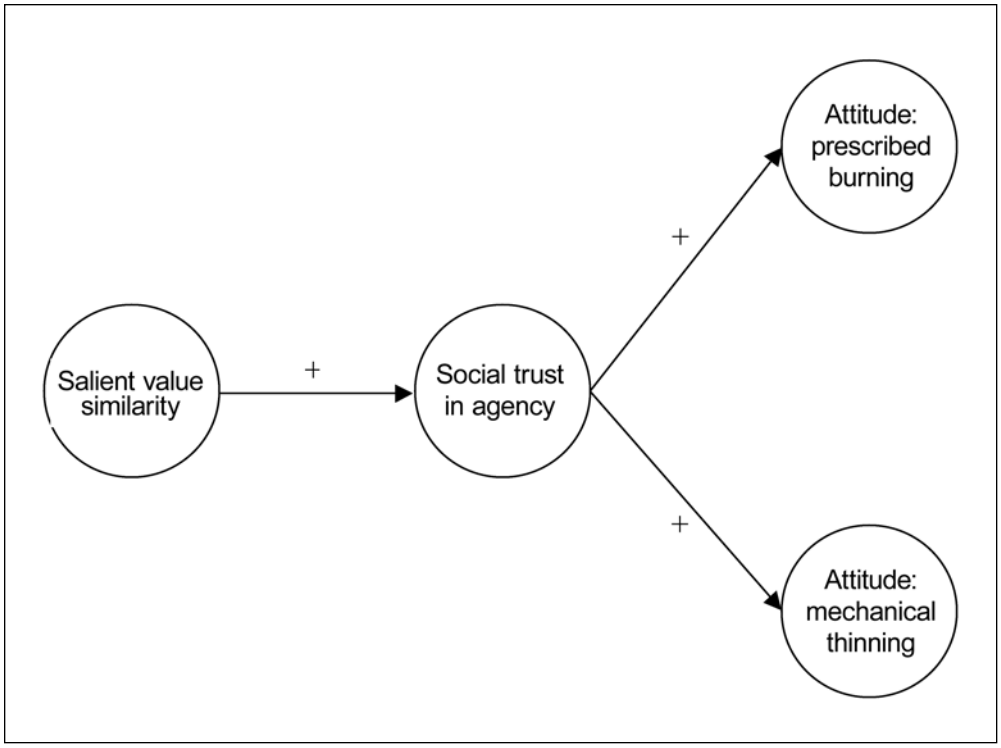

Figure 9—Hypothesized relationships between salient value similarity, social trust, and attitudes toward prescribed burning and mechanical thinning.

Study Area

The study area for this investigation included six counties in Colorado (Boulder, Clear Creek, Gilpin, Grand, Jackson, and Larimer). The populations in these counties increased by an average of 33 percent between 1960 and 2000, with the largest increases occurring in Gilpin (55 percent) and Grand (56 percent) Counties. Although the six counties are considered part of Colorado's wildland urban interface, a mixture of rural and urban population centers is evident (e.g., Fort Collins, population = 137,177; Boulder, population = 94,673). Individuals living in developed locations can be affected by wildland fires. For the purposes of this study, however, our sampling frame was limited to landowners living in rural locations in each of the six counties. We used the Census Bureau's 2000 definition of rural (i.e., population density < 1,000 people per square mile; Census Bureau 2000) and operationalized "rural" using local maps and zipcodes. Individuals living in areas near forested lands may be at greater risk from wildland fires and are more likely to be aware of prescribed burning and mechanical thinning.

Colorado has 22 million acres of forested landscape. A substantial portion of these lands are in the six counties in our study area. For example, over 50 percent of Larimer County is publicly owned, most of which is land within the Arapaho-Roosevelt National Forest. The Arapaho-Roosevelt also extends into Boulder, Clear Creek, Gilpin, Grand, and Jackson Counties. Although other private and public lands in these counties are managed by a variety of state (e.g., Colorado State Forests) and national agencies (e.g., National Park Service), the USDA Forest Service manages more forested land than any other agency. For this reason, our analyses of shared value similarity and agency trust focused on the USDA Forest Service. Other land management agencies may or may not have a similar relationship with residents' views on SVS and social trust.

Although precise estimates are not available for the amount of land treated by prescribed burning and mechanical thinning, the USDA Forest Service and its partnership agencies (e.g., Colorado State Forest Service, National Park Service) identified 510,000 acres in Colorado as high priority for treatment (300,000 in the Pike National Forest, 140,000 in Arapaho-Roosevelt National Forest and 70,000 acres of nonfederal land) (Baker et al. 2004).

Methods

The study population consisted of landowners over the age of 18 who reside in the rural areas (Census Bureau 2000) of the six Colorado counties (Boulder, Clear Creek, Gilpin, Grand, Jackson, and Larimer). A random sample of resident names and addresses was purchased from a commercial sampling firm in the summer of 2004.

Mail Survey Administration

Four mailings were used to administer the survey beginning at the end of May 2004. Residents first received the 12-page questionnaire, a prepaid postage return envelope and a personalized cover letter explaining the study and requesting their participation. Ten days after the initial mailing, a reminder postcard was sent to participants. A second complete mailing (questionnaire, prepaid postage return envelope, and cover letter) was sent to nonrespondents 10 days after the postcard reminder. To further increase the response rate, a third complete mailing was sent 1 month following the second complete mailing. A total of 532 completed surveys were returned giving an overall response rate of 47 percent (532 returned/(1,200 sent - 56 nondeliverables)).

As a check on potential nonresponse bias, a telephone survey was conducted of nonresponse residences (n = 100). Selected key issues (perceived effectiveness, approval, and aesthetic impacts of prescribed burning and mechanical thinning) were addressed in the telephone survey. Differences between respondents and nonrespondents on these central topics were "minimal" (Hedges' g effect sizes < 0.2) (Vaske et al. 2002). Thus, nonresponse bias was not considered to be a problem, and the data were not weighted.

Variables in Model

Predictor-salient value similarity—

Following Siegrist et al. (2000), salient value similarity was measured with five questions. Respondents were asked "With respect to forest fire management, I feel the USDA Forest Service": (1) shares values similar to mine, (2) shares opinions similar to mine, (3) thinks in a way similar to me, (4) takes actions similar to what I would, and (5) shares goals similar to mine. Responses were given on a 7-point scale ranging from "strongly disagree" (1) to "strongly agree" (7).

Mediator-social trust—

We differentiated trust-in-management from forest information.

Respondents were asked a series of questions to assess social trust. These were used to construct a multiple-item index of social trust, which served as the mediator in the models. One variable consisted of a three-question "trust-in-management" index. Respondents were asked their agreement with: I trust the USDA Forest Service knows how to: (1) effectively plan prescribed burns, (2) use mechanical thinning effectively, and (3) respond to forest fires. A second indicator of social trust was based on four questions concerned with trust in USDA Forest Service information: With respect to forest fire management, I trust the USDA Forest Service to

provide: (1) the best available information on forest fire issues, (2) me with enough information to decide what actions I should take regarding forest fire, (3) truthful information about safety issues related to forest fire, and (4) timely information regarding forest fire issues. Survey items in both the "trust management" and "trust information" indices were measured on a 7-point scale from "strongly disagree" (1) to "strongly agree" (7). The third social trust variable, agency performance, was a single-item indicator. Respondents were asked to assign a letter grade to the USDA Forest Service based on their opinion of the job that the agency has done managing wildland fires. Response categories were based on an A (4) to F (0) scale (best to worst) that included intermediate grades (e.g., A- = 3.75, B+ = 3.50).

Criterion variables—
Attitudes toward prescribed burning and mechanical thinning were each measured with three survey items. Respondents were asked (1) How effective are prescribed burns (and mechanical thinning) in preventing subsequent fires from getting out of control? (measured on a 9-point scale ranging from "not at all effective" [1] to "extremely effective" [9]); (2) Do you approve or disapprove of the use of prescribed burns (and mechanical thinning) in forests? (measured on a 9-point scale ranging from "strongly disapprove" [1] to "strongly approve" [9]); and (3) Do prescribed burns (and mechanical thinning) make the forest look better or worse? (measured on a 9-point scale ranging from "extremely worse" [1] to "extremely better" [9]).

Analysis Strategy

The internal consistency of the SVS, social trust, and attitude latent indices were examined using Cronbach's alpha and confirmatory factor analysis. A structural equation path analysis was used to assess the mediation role of social trust. Two models were fitted in AMOS 5 statistical software using the variance and covariance matrices. In the partial mediation model, the predictor (SVS) influenced the criterion constructs (attitudes toward prescribed burning and mechanical thinning) directly and indirectly through its effect on the mediator (social trust). In the full mediation model, the predictor (SVS) only influenced the criterion constructs (attitudes) indirectly through its effect on the mediator (social trust). Comparisons of the partial and full mediation models were based on indicators of robustness and goodness of fit ($\Delta \chi^2$, χ^2 / df, and the NFI, CFI, and RMSEA indices).

Results

Sample Characteristics

Given our sampling design, 49 percent of the respondents lived within a forested area; another 22 percent lived less than 1 mile from a forest, and 22 percent resided from 1 to 5 miles from a forest. Nearly two-thirds (64 percent) of the respondents were male, with an average age of 56 years and an average annual income of $71,500. One-third had a 4-year college degree and another 27 percent held an advanced college degree (e.g., master's, Ph.D.). Over 80 percent were year-round residents at the location where the survey was delivered, and 93 percent owned their home.

Scale Reliabilities

With respect to forest fire management, Colorado residents believed that they shared values (M = 4.86, SD = 1.53), opinions (M = 4.64, SD = 1.54), thoughts (M = 4.51, SD = 1.57), and goals (M = 4.70, SD = 1.57) similar to those of USDA Forest Service managers (table 45). Respondents also believed that they would act (M = 4.48, SD = 1.62) similarly to the Forest Service managers. The reliability coefficient for these five survey items was 0.96, indicating that when the items are combined to create a single index, the index had high internal consistency. Deleting any of the items did not improve the scale's overall reliability.

Table 45—Salient value similarity indicators

Salient value similarity indicators	Mean	Standard deviation	Cronbach alpha if item deleted	Cronbach alpha
With respect to forest fire management, I feel that the U.S. Forest Service:[a]				0.96
Shares similar values as me.	4.86	1.53	0.94	
Shares similar opinions as me.	4.64	1.54	.94	
Thinks in a similar way as me.	4.51	1.57	.94	
Takes similar actions as I would.	4.48	1.62	.95	
Shares similar goals as me.	4.70	1.57	.95	

[a] Responses given on 7-point scale: (1) strongly disagree, (2) moderately disagree, (3) slightly disagree, (4) neutral, (5) slightly agree, (6) moderately agree, (7) strongly agree.

Social trust was measured using three sets of variables (i.e., a trust-in-management index, a trust-in-information index, and a single-item indicator of the agency's performance grade). In general, respondents trusted Forest Service management to effectively plan prescribed burning (M = 4.80, SD = 1.71), use

mechanical thinning effectively (M = 5.17, SD = 1.60), and to respond to forest fires appropriately (M = 5.68, SD = 1.36). The reliability coefficient for these three items was 0.77 (table 46). The mean for the index was 5.22 with a standard deviation of 1.28. Similar evaluations were given regarding the trust in Forest Service information (e.g., provide the best available information on forest fire issues). The means for the four trust-in-information items ranged from 5.52 (provide timely information) to 5.77 (provide truthful information about safety issues related to forest fire) and the overall Cronbach's alpha for the trust-in-information index was 0.93. The final variable representing the social trust concept, overall agency performance grade with respect to handling forest fire in Colorado, had an average score of 3.23 (a letter grade of B) and a standard deviation of 0.79. Taken together, the trust-in-management index, trust-in-information index, and overall agency grade had a reliability coefficient of 0.77.

Table 46—Social trust indicators

Social trust indicators	Mean	Standard deviation	Cronbach alpha if item deleted	Cronbach's alpha
Trust in U.S. Forest Service management[a]				0.77
I trust that the U.S. Forest Service knows how to:				
Effectively plan prescribed burns	4.80	1.71	0.63	
Use mechanical thinning effectively	5.17	1.60	.62	
Respond to forest fires	5.68	1.36	.74	
Trust management index	5.22	1.28		
Trust in U.S. Forest Service information[a]				
With respect to forest fire management, I trust the U.S. Forest Service to provide:				.93
The best available information on forest fire issues	5.59	1.40	.92	
Me with enough information to decide what actions I should take regarding forest fire	5.69	1.33	.91	
Truthful information about safety issues related to forest fire	5.77	1.31	.91	
Timely information regarding forest fire issues	5.52	1.50	.92	
Trust information index	5.64	1.27		
Agency Performance Grade[b]				
Taking everything into consideration, how would you grade the U.S. Forest Service for handling forest fire in Colorado?	3.23	.79		
Overall Social Trust[c]	4.69	.92		.77

[a] Responses given on 7-point scale: (1) strongly disagree, (2) moderately disagree, (3) slightly disagree, (4) neutral, (5) slightly agree, (6) moderately agree, (7) strongly agree.

[b] Responses originally given on a 10-point scale: (4.00) A, (3.75) A-, (3.50) B+, (3.00) B, (2.75) B-, (2.50) C+, (2.00) C, (1.75) C-, (1.00) D, (0.00) F.

[c] The "overall social trust" variable includes trust management index, trust information index and agency performance grade.

Attitude toward prescribed burning was measured by using three survey items that addressed effectiveness (M = 6.74, SD = 1.44), approval (M = 6.85, SD = 1.87), and aesthetic impact (M = 5.65, SD = 2.04). The overall Cronbach's alpha was 0.83 (table 47). Attitude toward mechanical thinning was measured by using an identical set of three variables. Results were similar to attitude toward prescribed burning. The means for mechanical thinning items ranged from 6.31 (aesthetic impact) to 7.04 (approval), and the index had a reliability coefficient of 0.81.

Table 47—Attitudes toward prescribed burning and mechanical thinning

Attitude toward	Mean	Standard deviation	Cronbach alpha if item deleted	Cronbach's alpha
Prescribed burning:				0.83
How effective are prescribed burns in preventing subsequent fires from getting out of control?[a]	6.74	1.44	0.77	
Do you approve or disapprove of the use of prescribed burns in forests?[b]	6.85	1.87	.65	
Do prescribed burns make the forest look better or worse?[c]	5.65	2.04	.81	
Mechanical thinning:				.81
How effective is mechanical thinning in preventing subsequent fires from getting out of control?[a]	6.84	1.56	.81	
Do you approve or disapprove of the use of mechanical thinning in forests?[b]	7.04	1.89	.64	
Does mechanical thinning make the forest look better or worse?[c]	6.31	1.98	.72	

[a] Responses given on 9-point scale: (1 and 2) not at all effective, (3 and 4) slightly effective, (5, 6, and 7) moderately effective, (8 and 9) extremely effective.

[b] Variable coded on 9-point scale: (1 and 2) strongly disapprove, (3 and 4) slightly disapprove, (5) neutral, (6 and 7) slightly approve, (8 and 9) strongly approve.

[c] Variable coded on 9-point scale: (1 and 2) extremely worse, (3 and 4) slightly worse, (5) neither, (6 and 7) slightly better, (8 and 9) extremely better.

Mediation Models

Having demonstrated the reliability of the constructs separately, confirmatory factor analysis was used to examine the relationship between each of the observed variables and the four latent constructs (SVS, social trust in the agency, attitude toward prescribed burning, and attitude toward mechanical thinning) (fig. 10). The standardized factor loadings were consistently greater than 0.64 ($p < 0.001$). Modification indices indicated that the fit of the model could not be improved by allowing any of the observed variables to load on a different latent construct.

Hypothesis 1 was tested using two structural equation models. We predicted that social trust would mediate the relationship between SVS and attitudes toward prescribed burning and mechanical thinning. Support for this hypothesis was evident by comparing the full and partial mediation models (table 48). The partial

Table 48—Goodness-of-fit indices for structural equation models

Mediation models	χ^2	df	*p*-value	χ^2/ df	NFI	CFI	RMSEA
Full mediation model	440.94	74	< 0.001	5.96	0.917	0.930	0.097
Partial mediation model	438.19	72	< .001	6.09	.917	.930	.098
D c^2 (full - partial models)	2.75	2	n.s.				

mediation model (χ^2 = 438.19, df = 72, p < 0.001) was statistically equivalent to the full mediation model (χ^2 = 440.94, df = 74, p < 0.001); and the change in chi-square statistic was not significant ($\Delta\ \chi^2$ = 2.75, df = 2, n.s.). In addition, measures of model quality (χ^2 / df [5.96], NFI [0.917], CFI [0.930], and RMSEA [0.079]) were acceptable for the full mediation model. For all of these reasons, the full mediation model was used to describe the data.

As salient value similarity increased, social trust in the agency increased.

As predicted by hypothesis 2, as salient value similarity increased, social trust in the agency increased (β = 0.78, p < 0.001, fig. 10). Similarly, as social trust increased, approval of prescribed burning (β = 0.27, p < 0.001) and mechanical thinning (β = 0.23, p < 0.001) increased. These findings support hypotheses 3 and 4.

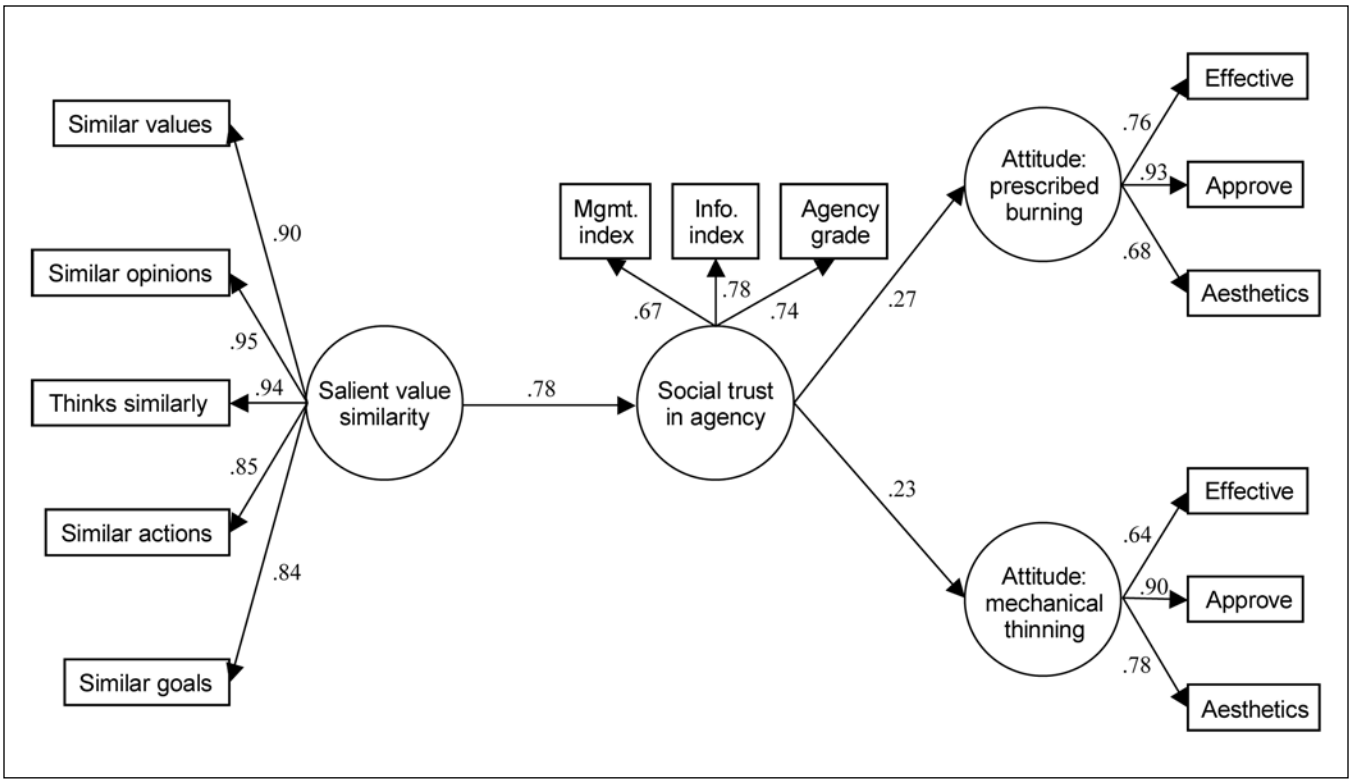

Figure 10—Confirmatory factor analyses and full mediation structural equation model. Path coefficients are standardized regression coefficients. All coefficients are statistically significant (p < 0.001).

Conclusion and Discussion

This paper developed a conceptual model to explain the relationships among (1) salient value similarity, (2) social trust in the USDA Forest Service, and (3) attitudes toward wildland fire management strategies. The SVS model served as the conceptual foundation for the predicted relationships. The findings highlighted both applied and theoretical implications for understanding attitudes toward wildland fire management strategies.

Management Implications

Social trust in the agency and attitudes toward prescribed burning and mechanical thinning are related.

For land management agencies such as the USDA Forest Service, establishing and maintaining trust is an ongoing challenge. Our research shows why efforts to build and maintain trust are important. Social trust in the agency and attitudes toward prescribed burning and mechanical thinning are related. Studies of other issues such as nuclear power have shown a much stronger relationship between trust and related attitudes such as perceived risk (Flynn et al. 1992, Siegrist et al. 2000). Nuclear power, however, is a technology created and controlled by humans, whereas wildfires can occur naturally and are perhaps viewed as a force of nature. Homeowners may trust the managing agency, but feel that wildfires, even prescribed burning, are beyond agency control. Agencies may need to do more to communicate with individuals about their strategies for managing wildfires and their expectations, capabilities, or objectives in fighting them.

Findings also revealed that, on average, homeowners agreed that they shared views similar to those of the Forest Service and trusted the agency to manage wildfires appropriately. This is important for several reasons. First, salient value similarity and trust can influence support of agency goals, objectives, and management (Earle 2004). For example, individuals in our study who shared values similar to those of the Forest Service reported more trust in the agency; those who trusted the agency were more likely to support prescribed burning and mechanical thinning.

Second, what we know about persuasion (e.g., from elaboration likelihood or heuristic systematic models) suggests that value similarity and trust are important determinants of effective communication and persuasion (Chaiken et al. 1996, Petty and Cacioppo 1986). Our findings suggest that individuals who trust an agency may be more motivated to attend to information campaigns.

Third, agencies should strive to understand constituents' opinions, values, and goals. To preserve trust and a strong constituent base, management should be tailored to reflect local views whenever feasible. If constituents' views are not

reflected in management, reasons for inconsistencies should be shared so they can be weighed in relation to considerations of trust (Cvetkovich and Winter 2003).

Theoretical Implications

From a theoretical perspective, finding a strong positive relationship between SVS and trust is consistent with past research (Siegrist et al. 2000, Winter et al. 2004). Researchers should continue to examine measures of perceived similarity, as they seem to be important determinants of social trust. Given the factor loadings and reliabilities, variables used here and in other studies appear to be appropriate for measuring SVS.

The association between social trust and attitude is less clear. Some studies have reported strong relationships between related concepts (e.g., trust and perceived risk) (Flynn et al. 1992, Siegrist et al. 2000). Findings here, however, were consistent with research reporting relatively weak relationships (e.g., Needham and Vaske 2008; Sjöberg 2000b, 2001; Viklund 2003). Given that most of the variance in these concepts remains unexplained by trust, other attributes such as knowledge, control, and newness may also contribute to respondents' perceptions (e.g., Fischhoff et al. 1978, Sjöberg 2000a).

There is inconsistency in the conceptualization and measurement of trust. Some researchers contend that trust is multidimensional and consists of dimensions such as caring, responsibility, competence, fairness, and confidence (Johnson 1999, Poortinga and Pidgeon 2003). Factor loadings and reliabilities reported here, however, support the unidimensional interpretation of social trust (Siegrist et al. 2000, 2001; Winter et al. 1999).

Future Research

To increase the generalizability of these findings, the following research considerations are offered. First, this article examined homeowners' attitudes toward prescribed burning; not examined were the potential risks associated with prescribed burning that may influence individuals' views. People tend to believe that they are at less risk than others (i.e., risk denial) (Sjöberg 2000a, Slovic et al. 1981). Research is needed to assess how individuals assign judgments of risk.

Second, this article investigated respondents' perceptions of similarity, trust, and attitude. Research has shown that experts (i.e., scientists, agencies), constituent/interest groups, and the public can differ in their perceptions. Experts, for example, tend to judge risks differently and as less severe compared to others (Sjöberg 1999, Taylor et al. 1988).

Third, most studies investigating relationships among SVS and social trust have focused on a single agency (e.g., USDA Forest Service). Whether our findings generalize to other natural resource agencies such as the Colorado State Forest Service or the National Park Service remains an empirical question.

Fourth, homeowners' attitudes were only partially influenced by trust in the agency. Researchers have identified various other determinants of attitudes and perceived risk including dread, knowledge, control, and newness (e.g., Fischhoff et al. 1978, Sjöberg 2002). Slovic (1987) explored these perceptions of risk in the context of a psychometric paradigm. Understanding wildland fires within the context of the psychometric model may facilitate risk analysis and policy development.

Understanding wildland fires within the context of the psychometric model may facilitate risk analysis and policy development.

Fifth, our operationalization of SVS in this paper was identical to prior theorizing and empirical work based on the SVS model (e.g., Siegrist et al. 2000). We have, however, also developed scales for measuring value orientations (i.e., patterns of basic beliefs) about wildfire management (e.g., Bright et al. 2005) based on the theoretical work of Rokeach (1973). These basic beliefs include dimensions such as biocentrism, anthropocentrism, responsibility, and freedom. Identification of these value orientations/basic beliefs has proven useful for predicting attitudes toward fire policies, norms for agency reactions to wildfire, and fire-related homeowner behaviors such as creating defensible space (Absher and Vaske 2007). Research that directly compares SVS measures of value similarity against the Rokeach-based value orientations may further facilitate understanding the foundations of individuals' attitudes, norms, and behaviors associated with wildland fire management.

Sixth, identical to most previous research on SVS and social trust, this article is quantitative and cross-sectional in nature. It is likely, however, that these concepts are dynamic, not static. Longitudinal or panel design studies are needed to obtain time-series data. Studies have found utility in applying qualitative methods to examine these concepts (e.g. Cvetkovich and Winter 2003, Earle 2004, Winter et al. 1999). These approaches may be useful for providing depth and detail necessary for delineating underlying influences and dimensions of perceived similarity and trust.

Finally, the concepts of SVS and social trust have generated considerable interest in the risk literature, but have received little attention in natural resource fields. Given the contentious nature of many natural resource issues, drawing on the risk literature may facilitate a better understanding of stakeholders and, consequently, the challenges faced by resource managers. This study should be viewed as a starting point in that direction. Researchers are encouraged to address research needs identified here to further understand the human dimensions of wildfire management.

Acknowledgments

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Metric equivalents

1 mile = 1.609 kilometers
1 acre = 0.405 hectares
1 square mile = 2.59 square kilometers

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