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Geographic Variation in Social Acceptability of Wildland Fuels Management in the Western United States

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Contemporary natural resource management requires consideration of the social acceptability of management practices and conditions. Agencies wishing to measure, respond to, and influence social acceptability must understand the nuances of public perception regarding controversial issues. This study explores social acceptability judgments about one such issue: reduction of wildland fuel hazards on federal lands in the western United States. Citizens were surveyed in four locations where fire has been a significant ecological disturbance agent and public land agencies propose to reduce wildland fuel levels and wildfire hazards via prescribed burning, thinning, brush removal, and/or livestock grazing. Respondents in different locations differed in their knowledge about fire and fuel issues as well in their acceptability judgments. Differences are associated with location-specific social and environmental factors as well as individual beliefs. Results argue against using "one-size-fits-all" policies or information strategies about fuels management.

Keywords attitudes, fire, forests, knowledge, rangelands, social acceptability, wildland fuels

Land managers worldwide are increasingly called on to manage forest and rangeland ecosystems in ways that can simultaneously sustain biophysical, economic, and social aspects of those systems (World Commission on Environment and Development 1987; Clark 1999). On federal lands in the United States such management requires attention to the social acceptability of management practices and resulting

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conditions of forests and rangelands (Dombeck 1996; Thomas 1996)—that is, the degree to which citizens understand and support management actions on lands held in the public trust.

Moreover, managers must understand the social acceptability of their activities within multiple spatial, temporal, and social contexts. Citizens' judgments can vary across geographic space (Brunson and Steel 1996), time (Bengston et. al 2001), and social affiliations (Steel et al. 1998). Federal land managers must try to address local concerns while reflecting national values and goals, and also to adapt to immediate needs and conditions while sustaining resources far into the future. Shindler et al. (2002) identified the lack of attention to these contextual aspects as a key problem in incorporating social acceptability into natural resource management.

The recent challenges of wildfire and fuels management have increased the need for greater understanding of public perceptions of these issues. Natural resource professionals who hope to influence the acceptability of practices that have scientific validity but are poorly understood by the public have a particularly complex assignment (Shindler et al. 1996; Lauber et al. 2002). To aid in understanding the context of social acceptability in forest and rangeland management, we studied geographic variability in public acceptance of wildland fuel treatments for reducing wildfire hazard on public lands.

Citizen surveys were conducted in four location across the West. Fire is a significant ecological disturbance agent in each area, leading public land agencies to propose reducing vegetative fuel levels and associated wildfire hazards using prescribed burning, thinning, brush removal, and/or livestock grazing. In addition, each location has seen significant population growth in recent years, particularly within the wildland–urban interface. However, the study areas differ in terms of ecosystem type, prevailing local management practices, and social characteristics (e.g., demographics, political traditions).

This research has theoretical relevance because it increases our understanding of how contextual aspects influence acceptability judgments about forest and rangeland management, and also about how such contextual factors are related to attitudes and beliefs. It has policy relevance because it addresses whether top-down national approaches to wildfire and fuels policy are likely to be accepted equally in different land management contexts. And it has applied management relevance because it can show agency officials some of the factors that influence whether citizens living near their jurisdictions will accept particular practices, as well as the extent to which educational approaches should be tailored to local audiences.

Issue Background

The ecosystem management paradigm that guides contemporary U.S. natural resource management has, as one of its central elements, the need to consider the social dimension of management practices (Dombeck 1996; Thomas 1996; Cortner and Moote 1999). Another key element is a focus on ecosystem health and sustainability rather than on production of specific outputs such as sawlogs or recreation visits. As a result, activities are typically described and planned to address concerns about forest and rangeland health such as insect epidemics, nonnative plant invasions, riparian degradation, or wildland fuel loads.

Recent attention to wildland fuels as a management issue arises from the recognition that U.S. fire suppression policies have had the unanticipated effect of increasing fire hazards. For most of the 20th century, federal agencies have actively

suppressed most wildfires to protect timber and forage supplies, wildlife habitat, water quality, recreation facilities, and rural homes. While suppression activities originally reduced the size and duration of wildfires, they also have fostered accumulations of vegetative fuels that are generally thought to far exceed what had existed historically (Fulé et al. 2001). High fuel loads burn with greater intensity, spread more rapidly, and are harder to control, increasing threats to both natural and human environments (Dennis 2001; Interagency Working Group 2001).

U.S. wildland fire policy has always reflected public will as much as scientific judgment. The initial push by the Forest Service for immediate wildfire suppression was a response to huge western wildfires in 1910 (Pyne 1997; Ring 2003), while more recently a National Park Service "let burn" policy was curtailed due to public outcry over the 1988 Yellowstone fires, even though the ecological benefits of those fires became known quickly (Lichtman 1998). A review of national fire policy after 1988 called for "use of planned burning and other efforts to reduce hazard fuels" (Wakimoto 1990, 24), especially in the wildland–urban interface. The fuel accumulation issue truly became politically urgent after a wildfire in 2000 burned 70 homes in Montana's Bitterroot Valley, and Arizona, Colorado, and Oregon each experienced their largest fires ever in 2002 (Adams 2002; Ring 2003). The sense of urgency is enhanced by dire predictions of ecological and economic catastrophe, as in this recent statement from a pro-timber industry magazine:

> Time is running out for forests in the Southwest. Wildfires and insects are devouring them in a dead-dance unlike anything anyone has ever seen: unlike anything for which scientists can find precedent in nature. If Congress does not soon heed the urgent warnings of eminent scholars ... the region's forests will be lost. (Petersen 2003, 2)

Yet there remains disagreement over the means by which fuel loads should be reduced. While some forest thinning projects have gained broad local support (Farnsworth et al. 2003; Little 2003), environmentalists nationally have been suspicious of thinning activities—in part because prescribed fire more closely mimics natural disturbance patterns, but also because they generally mistrust federal forest agencies, which they accuse of using fuels reduction as an excuse for logging (Shouse 2002; Ring 2003). The timber industry and many foresters are equally suspicious of prescribed fire, which they describe as wasteful and unnecessarily dangerous, especially after more than 200 homes burned in Los Alamos, NM, when a prescribed burn blew out of control (Holloway 2000; Nelson 2002). Similar debates rage over the use of livestock grazing as a tool for vegetation manipulation in fire-prone areas (see Wuerthner 2002).

Conceptual Background

Social Acceptability

Although natural resource decision makers have long known that management actions must be "socially acceptable," until recently there had been no attempt to define the concept within social science. Brunson (1996) described *acceptability* in ecosystem management as a condition resulting from comparative judgments, wherein the object being judged is "acceptable" only if rated as superior or sufficiently similar to imagined alternatives. *Social* acceptability is simply an aggregate of these positive and negative judgments. Brunson (1996) further noted that

acceptability tends to be observable only insofar as it is reflected in behaviors that indicate its absence, such as testifying at a public hearing or complaining to peers about a proposed action or existing condition.

Two assumptions underlying Brunson's (1996) definition are relevant to the design of this research. First, if acceptability is a comparative process, the evaluator must hold cognitive beliefs about the object—objective knowledge and perceptions of outcomes—that allow for distinguishing among real or perceived alternatives. Acceptability judgments are subject to reconsideration with acquisition of any new information, whether obtained through formal (education, public outreach) or informal (personal experience, word of mouth) channels. Therefore to understand social acceptability, it is useful to have knowledge about stakeholders' cognitive beliefs regarding the object being evaluated. Second, if public acceptance is recognized primarily through behaviors of stakeholders, then the scientific study of acceptability can be informed by the use of belief-attitude-behavior models drawn from social psychology.

Belief–Attitude–Behavior Models

Numerous researchers have developed social–psychological models of the relationships between beliefs, attitudes, and behaviors (e.g., Bem 1970; Ajzen and Fishbein 1980; Eagly and Chaiken 1993). Subsequently, researchers have applied these belief–attitude–behavior (B-A-B) models to a wide variety of natural resource management issues, from wolf reintroduction (Pate et al. 1996) to ecological restoration (Bright et al. 2002) to nonmarket valuation (Pouta and Rekola 2001). While B-A-B models differ somewhat in their specifics, they typically share common elements. Attitudes, or subjective judgments about an "object" such as a policy or management action, are said to result from an interaction of cognitive beliefs (which include both knowledge and misinformation) and affective (emotional or aesthetic) responses to the object, as moderated by value orientations (i.e., patterns of fundamental beliefs about a class of objects or behaviors) and normative influences.

On the specific topic of wildfire and fuels management, early attitude studies focused on public attitudes toward fire management in general (Cortner et al. 1984; Gardner et al. 1985; Taylor et al. 1986), and more specifically on the influence that knowledge about fire has on attitudes (Carpenter et al. 1986; Manfredo et al. 1990). Generally these researchers found that attitudes toward wild and prescribed fires were more positive among citizens who understood the natural role of fire in ecosystems. As public understanding of fire ecology has increased in recent years, so has tolerance for wild and prescribed fires (Cortner et al. 1990).

More recent studies have focused on hazard reduction, particularly at the wildland–urban interface (Winter and Fried 2000; Jacobson et al. 2001; Loomis et al. 2001) or in areas with significant forest health problems (Shindler and Reed 1996; Shindler and Toman 2003). While most researchers have focused on prescribed fire as the primary management tool, Shindler and his colleagues compared attitudes toward prescribed fire and mechanical vegetation removal, finding widespread support for both although respondents did not want to see controlled burning in all locations (Shindler and Toman 2003). Most of these studies have been location specific, such as Cortner et al. (1984) in Arizona, Loomis et al. (2001) in Florida, and Shindler and Reed (1996) in Oregon. Loomis et al. (2001) compared their results with those from other regions and found more differences than similarities in both attitudes and knowledge about prescribed fire. Winter et al. (2002) conducted focus

groups in California, Florida, and Michigan and found that the concerns underlying public attitudes toward urban-interface fuel treatments were similar, although they did find some differences associated with study locations.

Methods

Research Approach and Hypotheses

Studies of attitudes regarding natural resource issues typically test the applicability of a preferred B-A-B model to a particular situation or class of objects. However, in this study we focus on how contextual factors—geographic location and evaluator characteristics—are associated with judgments about an issue. Attitudes differ from acceptability judgments in that the latter entail comparison of potential conditions and perceived outcomes while the former do not—that is, a person can hold a negative attitude toward an object yet find it acceptable because the alternatives are judged even worse. Yet both are formed via evaluation processes involving the interaction of cognitive beliefs, affective responses, and values. Therefore our dependent variables include judgments of the acceptability of management practices; knowledge of wildfire and its impacts as well as of fuels management (as measures of cognitive beliefs); and concerns about fuels management that arise from affect and values. Because attitudes are usually measured by responses to discrete statements with no contextual cues, while acceptability arises from comparative judgments that are inherently contextual, we also included trade-off questions that asked respondents to choose between pairs of alternatives that, by themselves, might be judged either positively or negatively.

Contextual factors most clearly influence the evaluation process in the formation of cognitive beliefs (Shindler 2000). Knowledge is shaped by social influences—mainly education and peer interactions—and also by personal experience (Bem 1970). Residents of a given region often share experiences that are not typical for residents of other regions (Manfredo et al. 1990); this is especially true for experiences in nature because ecotypes vary considerably across the United States. Therefore our primary independent variable is geographic location. Our research hypotheses were as follows:

H_1: Judgments about the acceptability of fuels treatments will vary across study locales.
H_2: Cognitive beliefs about wildfire and fuels treatments will vary across study locales.
H_3: Geographic differences in acceptability judgments and cognitive beliefs will be associated with social and ecological factors associated with each locale.

Study Locations

Study locations were chosen because they met four criteria suggesting that management of wildland fuel loads would be a locally salient issue:

- Wildfire is a significant ecological disturbance agent in adjacent wildlands.
- Federal land management agencies in the area have proposed to reduce wildland fuel levels using prescribed burning, thinning, brush removal, and/or livestock grazing.
- The agencies have launched public outreach/education programs to raise awareness of wildfire hazard and fuels issues.
- Population growth exceeds national averages in all or part of the locale, with significant growth occurring in wildland–urban interface zones.

Based on the above criteria, four locations in the western United States were chosen. Each location consisted of one or more counties that contain lands managed by cooperating federal agencies.

Central Arizona highlands. Yavapai County, AZ, including the rapidly growing amenity communities of Prescott and Sedona. Dominant wildland types are ponderosa pine forest and oak–juniper savanna. At the time the sites were chosen (in 2000), there had been no significant wildfires in the area for several years, but high fuel hazard ratings had led local fire protection authorities and the Forest Service to cooperate in creating a citizens' wildland–urban interface committee that was actively promoting fuels reduction through televised public meetings and displays at public events. Both prescribed fire and mechanical treatment were actively occurring in the area.

Colorado Front Range. Boulder and Larimer counties, including the northern part of the Denver metropolitan area between the cities of Boulder and Fort Collins, a rapidly growing wildland–urban interface zone in the Rocky Mountain foothills, and tourist communities adjacent to Rocky Mountain National Park. Rapid population growth is fueled by universities and high-tech industry. Ponderosa and lodgepole pine stands dominate the forest area. Locally noteworthy wildfires had threatened or destroyed homes in the decade prior to the study, and the Forest Service proposed a mix of thinning and prescribed fire to reduce fuel hazards. Outreach included a widely distributed newspaper insert and public involvement activities associated with proposed fuels treatment projects such as the one already mentioned.

Central Oregon. Deschutes and Jefferson counties, including farming areas to the north and east and vacation communities on the west, with the fast-growing amenity towns of Bend and Redmond in between. Natural vegetation includes juniper woodland and ponderosa pine forest, with the latter having sustained recent large wildfires that threatened or damaged property. Rural homeowners' associations, the Forest Service, the Bureau of Land Management, and Confederated Warm Springs Tribes have been cooperating on fuel reduction activities, emphasizing mechanical removal and prescribed fire. Communication strategies included interpretive exhibits at visitor centers, agency newsletters, demonstration sites, and partnerships with local "friends" groups.

Utah Great Basin. Tooele and portions of Salt Lake and Utah counties, including the western suburbs of Salt Lake City and Provo plus portions of the sparsely populated West Desert. Frequent wildfires in nearby grasslands and oak–juniper woodlands have drawn public attention but property damage has been low. Grazing by goats has been used to reduce fuel hazards in oak thickets within a rapidly growing wildland–urban interface zone, while the Bureau of Land Management uses prescribed fire, mechanical treatments, and restoration planting to reduce fire hazard associated with invasion of non-native annual grasses. Outreach activities largely focused on displays at public events and contacts with local TV and newspaper outlets.

Survey Method

The survey included a variety of categorical and Likert-type items, based on previous studies by the investigators including one from a previous study of forest health in eastern Oregon (Shindler and Reed 1996; Shindler and Toman 2003). Variables include responses to scales measuring knowledge about fire and fuels management,

attitudes toward fuels-reduction practices, and levels of concern about fire-related phenomena such as smoke and safety. Acceptability was measured by first defining management practices (prescribed fire, mechanical vegetation removal, and grazing), then asking respondents to indicate whether they believe each practice is (1) "a legitimate tool that resource managers should be able to use wherever they see fit," (2) "something that should be done only infrequently, in carefully selected areas," (3) "a practice that should not be considered because it creates too many negative impacts," or (4) "an unnecessary practice." (In practice, the latter two responses were chosen so infrequently that we combined them in our analyses.) Respondents could also indicate they knew too little to make a judgment. Trade-off questions showed paired choices—for example, "Do not use fuels reduction practices in highly scenic locations" was paired with "Use fuels reduction practices in highly scenic areas even if doing so temporarily hurts scenic beauty." Respondents could choose one of the alternatives or indicate they were neutral or did not know enough to give an opinion.

Surveys were mailed to randomly selected households in each location. The original sample was 500 households per location, using addresses purchased from a private firm (Survey Sampling, Inc.). Samples for Colorado and Utah were stratified by oversampling rural households to ensure sufficient levels of responses from those areas. Due to address problems and changes in property holders, the actual number of deliverable surveys ranged from 346 to 476 (Table 1). Each household initially received a cover letter on Utah State University letterhead, postage-paid envelope, and 11-page 7-by-8 1/2-inch survey booklet. Reminder postcards were mailed to each home, and a second version of the survey and cover letter were sent to households from which no response had been received within 3 weeks.

Results

Survey Response

Response rates ranged from 52% in Oregon to 43% in Utah (Table 1). To test for nonresponse bias, 10% of nonrespondent households in each locale were randomly selected to receive a shorter, telephone version of the survey. There were few significant differences in responses between households surveyed by telephone and

TABLE 1 Survey Samples and Response Rates

State	Counties surveyed	Surveys delivered	Surveys received	Response rate	Percent judging topic salient[a]
Arizona	Yavapai	367	173	47%	63%
Colorado	Boulder, Larimer	346	164	47%	70%
Oregon	Jefferson, Deschutes	372	192	52%	67%
Utah	Salt Lake (western suburbs), Tooele	476	203	43%	42%

[a]Indicates percentage of respondents choosing the two highest response categories on a 5-point scale asking how much they have thought about wildfires.

by mail, with the major difference being that telephone respondents offered more "neutral" and "don't know" responses. Response rates to natural resource surveys have been declining over time, and they tend to be lower when questions are complex and/or not salient to all respondents (Connelly et al. 2003). The latter description is likely to pertain to our survey. For example, it appears that the topic is less salient to respondents from Utah, the location with the lowest response rate. When asked to rate on a five-point scale how much they had thought about wildfire, Utah respondents were considerably less likely to choose the two highest response categories (Table 1). The flip side of this trend in survey response is that citizens are more likely to respond to attitude surveys if they understand the complexity and importance of the issues being studied. Those are also the people most likely to participate in public policy debates over complex issues that matter to them (Steel et al. 1998).

Acceptability of Fuel Management

Table 2 displays frequency distributions, by location, for responses to the initial question about the acceptability of three fuels treatments: prescribed fire, mechanical vegetation removal, and grazing by livestock. In each location a substantial majority of respondents indicated that all three tools were acceptable in some or all situations; however, they were more likely to indicate that prescribed fire should be used more sparingly than either grazing or mechanical removal. Relatively few respondents believed the treatments should not be used at all. Overall, Oregonians were the most supportive with a majority of respondents in favor of using each treatment.

There were significant differences in acceptability for prescribed fire and mechanical removal between locations, but not for grazing. Oregonians were more likely to judge prescribed fire as an acceptable tool, while Utah respondents were more likely to suggest that both prescribed fire and mechanical removal should be used infrequently and only in selected areas.

TABLE 2 Initial Acceptability Ratings for Fuels Treatment Options

	Percent of respondents					
Practice and acceptability level	AZ	CO	OR	UT	χ^2	Significance
Prescribed fire						
Legitimate tool—use anywhere	46	48	56	37	21.2	<.05
Use infrequently in selected areas	45	45	34	49		
Do not use	5	3	7	6		
Don't know enough to judge	5	4	3	8		
Mechanical removal						
Legitimate tool—use anywhere	61	58	64	43	23.8	<.01
Use infrequently in selected areas	27	25	20	36		
Do not use	4	6	7	9		
Don't know enough to judge	8	10	10	12		
Livestock grazing						
Legitimate tool—use anywhere	70	63	60	72	13.9	NS
Use infrequently in selected areas	16	19	26	14		
Do not use	7	10	10	7		
Don't know enough to judge	7	8	5	7		

TABLE 3 Comparative Acceptability of Fuels Management Options

Comparison	Percent of respondents				χ^2	Significance
	AZ	CO	OR	UT		
Prescribed fire = preferred option	34	37	34	35	2.2	NS
Neutral	19	20	22	20		
Mechanical removal = preferred	37	33	36	36		
Don't know	11	11	9	8		
Use fire in rural and populated areas	28	36	32	30	9.1	NS
Neutral	24	23	18	20		
Do not use fire in populated areas	37	34	44	42		
Don't know	11	7	7	8		
No fuel reduction in scenic areas	22	12	23	26	19.8	<0.5
Neutral	19	23	18	22		
Reduce fuels even if hurts scenery	48	58	55	43		
Don't know	11	7	5	9		
Use grazing wherever it can help	64	53	59	67	11.9	NS
Neutral	12	19	17	15		
No grazing in recreation areas	18	22	20	16		
Don't know	7	6	4	3		

When acceptability was judged in comparative terms (Table 3), fewer differences were found. Four trade-off questions were asked. When asked to choose between prescribed fire and mechanical vegetation removal, respondents in all locations were split roughly evenly between the two choices, with a like number uncertain about an appropriate course of action. In all four states, respondents were slightly more likely to say prescribed fire should not be used in populated areas than to say it should be used wherever it can be helpful. Nor was there any difference in responses to a question about whether grazing should or should not be used in recreation areas, with all samples preferring to graze in recreation areas if it can be helpful in reducing fuel loads. However, Colorado respondents differed from those in the other locations in that they were more likely to support fuels reduction efforts even if it reduces scenic quality.

Cognitive Beliefs About Wildfire and Fuels Management

Differences were found in items measuring knowledge about wildfire ecology and impacts (Table 4) and perceived outcomes of fuels treatments (Table 5). While at least half of respondents in each location knew that wildfires typically do not kill most animals, Coloradoans were more likely to choose the correct response. A plurality in all states believed "wildfires kill a majority of large trees in a burned area," a statement that is not normally true in ponderosa pine forests (although the likelihood of truly stand-replacing fires has increased with the buildup of unnaturally high fuel loads). In Utah, where fires *do* tend to kill most juniper and oak trees in the systems typical of the area, citizens were more likely to agree with the statement. Although summer lightning causes most fire starts in each location, a majority of

TABLE 4 Responses to Cognitive Belief Statements Measuring Knowledge About Wildfire

Statement	Percent of respondents				χ^2	Significance
	AZ	CO	OR	UT		
Fires kill a majority of animals in a burned area						
Generally true	22	17	26	32	15.9	.014
Generally false	50	63	54	50		
Not sure	28	21	20	19		
Fires kill a majority of large trees in a burned area						
Generally true	49	50	53	77	52.3	<.001
Generally false	36	34	40	16		
Not sure	15	16	7	7		
The water quality in streams and rivers is often degraded in the first years after a wildfire						
Generally true	55	56	60	59	6.0	NS
Generally false	12	17	17	17		
Not sure	33	27	23	24		
Many plants require occasional fires so that new seeds and seedlings can sprout						
Generally true	84	87	82	79	9.6	NS
Generally false	4	3	7	10		
Not sure	12	10	11	11		
Humans cause most of the wildfires in this state						
Generally true	67	42	54	55	27.9	<.001
Generally false	21	48	38	36		
Not sure	12	10	12	9		

respondents in Arizona, Oregon, and Utah believed that humans cause most of the state's wildfires. Only in Colorado did a slight majority disagree with the statement. There was no difference in knowledge about the role of fire in water quality or in seedling regeneration.

A separate set of cognitive belief statements addressed perceived outcomes of fuels treatments. Responses to all four statements differed significantly among locales. Respondents tended to disagree with a statement that prescribed fire has little overall effect on wildfire intensity or frequency, but Oregon residents tended to disagree more strongly while Utah respondents were more likely to indicate that they didn't know. Similarly, Utah respondents were less sure about a statement that prescribed fire effectively reduces fuel amounts in most natural areas. In each location, respondents believed that mechanical vegetation removal is an effective way to reduce wildfire intensity and frequency, but Oregon respondents agreed much more strongly. When asked whether mechanical removal leaves unacceptable levels

TABLE 5 Responses to Belief Statements Measuring Perceived Outcomes of Fuel Treatments

Statement	Percent of respondents				χ^2	Significance
	AZ	CO	OR	UT		
Prescribed fire has little overall effect on the intensity or frequency of wildfires						
Strongly disagree	19	21	27	13	23.2	.03
Disagree	48	46	41	44		
Agree	17	17	21	24		
Strongly agree	5	4	1	2		
Don't know	11	12	10	17		
Prescribed fire effectively reduces amounts of fuel in most natural areas						
Strongly disagree	2	1	3	1	27.4	<.01
Disagree	8	5	6	7		
Agree	57	59	56	64		
Strongly agree	23	28	28	13		
Don't know	10	7	7	15		
Mechanical vegetation removal is an effective way to reduce intensity or frequency of wildfires						
Strongly disagree	2	1	1	6	51.7	<.001
Disagree	8	10	7	17		
Agree	56	61	30	53		
Strongly agree	17	13	55	8		
Don't know	16	14	7	17		
Mechanical vegetation removal often leaves behind unacceptable amounts of fuel in natural areas						
Strongly disagree	9	4	8	4	27.4	<.01
Disagree	32	24	42	32		
Agree	18	23	15	23		
Strongly agree	3	1	3	4		
Don't know	37	48	32	37		

of fuels behind after treatment, "don't know" was the modal response in Colorado and Utah while respondents were more likely to disagree in Oregon, where such practices are more common.

Affect and Values

Respondents in each location rated their level of concern about potential outcomes of prescribed fire. Three concerns had strong affective components: fears about human safety, increased levels of smoke—which for most people is primarily an aesthetic issue or health irritant—and reduced scenic quality (Table 6). There were

TABLE 6 Responses to Statements About Affective Concerns Regarding Prescribed Fire

Statement	Percent of respondents				χ^2	Significance
	AZ	CO	OR	UT		
Fears about human safety						
Great concern	22	24	21	27	20.6	.015
Moderate concern	21	21	17	23		
Slight concern	42	42	32	35		
Not a concern	16	15	29	15		
Increased levels of smoke						
Great concern	25	13	20	30	27.1	.001
Moderate concern	31	24	28	28		
Slight concern	26	42	29	30		
Not a concern	18	20	23	13		
Reduced scenic quality						
Great concern	17	12	13	21	19.4	.022
Moderate concern	26	22	31	26		
Slight concern	37	42	29	38		
Not a concern	21	24	27	15		

significant differences across locations for all three. Utah residents were more likely to classify all three concerns as "great." Oregon respondents were more likely to say human safety is *not* a concern, and Colorado respondents had lower levels of concern about smoke and reduced scenic quality.

The values that most strongly influence natural resource management attitudes are those pertaining to the proper balance of needs of human societies versus natural ecosystems (Brunson and Steel 1996; Shindler et al. 1996). Two items measured respondents' value orientations with respect to the role of humans in nature. A general question asked respondents to rate themselves on a 7-point scale (with 4.0 neutral midpoint) reflecting the relative importance of environmental versus economic concerns in natural resource decision-making. Colorado residents were significantly more likely to place themselves toward the environmental end of the spectrum, with a mean value of 2.9, while respondents from other locales rated themselves between 3.5 and 3.8 ($F = 12.7$, $p < .001$). In addition, we asked whether they agreed or disagreed with the statement, "Following nature's way is preferable to human intervention in ecosystems." Overall, 48% of respondents agreed and there were no significant differences among locales.

Social-Psychological Influences on Acceptability

Bivariate correlations, which are often used to analyze item importance in attitude studies (Mueller 1986), can help in evaluating the relative importance of cognitive, affective, and value influences on acceptability judgments (Table 7). Correlation analysis is a powerful statistical test that tends to find significant relationships in large samples, even when those relationships have little practical meaning—that is, they explain only a tiny proportion of the variance in responses. Therefore we have

set an a priori significance threshold of .316—a correlation that explains at least 10% of the total variance in responses (Brunson and Steel 1996). Because the data are categorical, a nonparametric test (Spearman's ρ) was used. Data for the four samples were combined because the correlations measured *within-subject* relationships so the question of location-level variability is not applicable. The analysis excluded "don't know" responses.

Using this criterion, acceptability judgments about prescribed fire were significantly influenced by cognitive beliefs about the effectiveness of this tool in influencing wildfire intensity and frequency, and by affective responses to concerns about scenic quality and increased smoke levels. Value orientation did not significantly influence acceptability judgments about fire. For mechanical vegetation removal, the only significant influences were cognitive beliefs about the effect of this practice on wildfire intensity or frequency and fuel loads. None of the variables were shown to have a significant influence on judgments about the acceptability of livestock grazing as a fuels management tool.

Additional analysis showed that acceptability judgments themselves were intercorrelated—that is, persons who found mechanical treatment to be acceptable also tended to find prescribed fire ($R = .48$) and grazing ($R = .38$) acceptable. However, judgments about prescribed fire and grazing were not significantly related ($R = .28$) using the 10%-of-variance criterion.

Discussion

Land management agencies wishing to implement fuels management practices must take care to ensure that their activities are socially acceptable. While the basic goal of

TABLE 7 Bivariate Correlations (Spearman's rho) of Acceptability Judgments with Cognitive, Affective, and Value Influences

Influence variable	Rx fire	Mechanical removal	Grazing
Cognitive influences			
Rx fire doesn't affect wildfire intensity or frequency	−.39[a]	—	—
Rx fire effectively reduces fuel loads	.08	—	—
Mechanical removal reduces wildfire intensity or frequency	—	−.56[a]	—
Mechanical removal leaves behind too much fuel	—	−.31[a]	—
Affective influences			
Level of concern about human safety	−.29	−.14	−.10
Level of concern about scenic quality	−.36[a]	−.17	−.06
Level of concern about smoke levels	−.33[a]	−.15	−.06
Value influences			
Placement on environment/economy scale	.01	.08	−.16
Position on human intervention in eco systems	.07	.18	.14

[a]Significance defined as explaining at least 10% of variance in responses.

reducing wildfire hazard is an easy one for citizens to support, individuals may differ considerably in their preferences for how the goal is met. As managers work with local stakeholders, it is important to understand the variability in public acceptance and the reasons for that variability across settings. Knowledge about which factors influence public preferences is also a useful tool in developing education strategies to enhance the acceptability of specific practices.

In this study we surveyed households in four western U.S. locations where wildland fuels management practices are proposed. Residents in all four locations believed that prescribed fire, mechanical vegetation removal, and livestock grazing should be part of the discretionary toolbox for fuels management on public lands. However, respondents tended to be a bit more wary of using prescribed fire, especially in populated areas, and more likely to say it should be used only infrequently. In partial support of Hypothesis 1, we found differences in acceptability associated with geographic location for two of the three treatments: prescribed fire and mechanical vegetation removal. Salt Lake City-area residents were less likely than respondents from other locations to give full acceptance to both treatments. Central Oregon respondents had fewer concerns about prescribed fire than others, and Colorado Front Range respondents were less likely to want to restrict uses to protect scenery.

Because acceptability judgments entail comparing alternative outcomes, evaluators must know enough about the possibilities to be able to make a choice. As other researchers have noted (Cortner et al. 1990, Loomis et al. 2001), we found evidence that citizens are relatively knowledgeable about wildfire—for example, a large majority knew that some plants need fires to regenerate; they also tended to know that fires do not typically kill most animals and that there can be a significant reduction in stream water quality in the first years after a burn. However, respondents were less knowledgeable about the effect of fires on trees, believing that fires kill most large trees even though that typically is not the case (except perhaps in western Utah).

As with acceptability, knowledge varied geographically, supporting Hypothesis 2. Respondents in all locations except the Colorado Front Range believe that humans cause most fires in their state. Oregon respondents were more likely to know about the positive benefits of mechanical removal. And Utah respondents seemed a bit more unsure about fuels treatments, as they were much less likely to indicate strong agreement with cognitive belief statements, and had the largest number of "don't know" responses to three of the four statements.

Hypothesis 3 stated that geographic differences in acceptability judgments and cognitive beliefs would be associated with social and ecological factors particular to the locations. This analysis requires a more qualitative assessment of the data. One important social factor may be urbanization. Respondents from the Utah location, the most urban of the four, were least likely to think a lot about wildfires in their area and most unsure about fuels management. This also squares with our own findings from a national attitude survey of urban and rural publics (Shindler and Brunson 2001). Ecological differences, and associated management histories, may also help to explain geographic differences. Although each location has nearby rangelands and forests, the Arizona and Utah locations are more heavily used for livestock grazing while logging is a less frequent activity when compared to Oregon. Thus it should not be surprising that citizens in the two former areas were most likely to say grazing is acceptable while Oregon was the only location where mechanical treatment was more acceptable than grazing.

Implications

From a social scientific standpoint, this research increases our understanding of the social acceptability construct as developed by Shindler et al. (2002). Findings confirm the importance of understanding the geographic context of acceptability judgments. Associations can be made with both social (urbanization) and biophysical (dominant land uses) environments in each location. Like Winter et al. (2002), we found geographic variation in respondents' concerns about the use of prescribed fire, but these differences did not appear to influence acceptability.

More importantly, this research increases our understanding of the social-psychological basis for acceptability judgments. The theoretical framework for this study assumed that acceptability judgments are primarily a product of cognitive processes, and that variability in acceptability would therefore reflect differences in cognitive beliefs. Although we cannot show causality, the correlation analysis tended to support these assumptions, as higher levels of knowledge about prescribed fire and mechanical removal were associated with higher levels of acceptability for those practices. With one exception—the association of acceptability of prescribed fire with concern about scenic impacts of fire—we did not find affective or value influences on acceptability judgments. The latter finding is interesting because it conflicts with other studies suggesting that attitudes toward natural resource management practices are strongly associated with value orientations toward the role of humans in nature (e.g., Steel et al. 1994; Brunson and Steel 1996). However, the discrepancy may lie in the fact that wildfire hazard reduction is a universally acceptable goal—so that differences in social acceptability pertain largely to how the goal is achieved—while previous researchers studied practices and policies that may be more contentious and not supported by all citizens (e.g., clear-cutting). In addition, the lack of a correlation between acceptability and fear and aesthetic responses may reflect the method, as a verbal question is unlikely to elicit as strong a response as actual threats or vistas.

It is worth emphasizing, however, that this study does *not* show that agencies can produce higher levels of public acceptance for wildland fuels treatments simply by increasing citizens' knowledge about them. First of all, this research measured behavioral *intentions*, and although we believe our approach provided the best available means of predicting responses, many studies have found that intentions do not always predict actual behaviors (e.g., Ajzen and Fischbein 1980). Moreover, while we found a clear association between cognitive beliefs and acceptability at the level of the geographic region, we also know that individual acceptance is likely to be associated with factors that can vary *within locale*, such as personal health status, trust in agencies or scientists, proximity of one's residence to a wildland boundary, or the role given to citizens in the planning process (Shindler et al. 2002). It may be tempting for managers or policymakers to conclude that educating people with "the facts" will lead to increased public support, but this is only true insofar as those facts are not in dispute—a circumstance that is rarely true in public land debates—and if citizens have sufficient trust in the information providers (Shindler and Toman 2003).

One of the most intractable problems in natural resource decision making is to determine the appropriate scale of influence upon decisions. Since federal lands belong to all citizens, all have standing in public policy processes. Yet local residents are disproportionately affected by decisions that result from those processes. Fire managers are concentrating fuel reduction treatments at the wildland–urban interface where problems are the most severe and risk is eminent. Because residents

in forest communities are often the first to respond to management programs, the focus on citizens at the local level is particularly relevant for agency personnel. Planning for contextual circumstances can often mean the difference between public acceptance and resentment toward these policies (Shindler et al. 2002).

This study offers no resolution to this dilemma, but it does underscore the need to consider local- and regional-scale acceptability. Policies based on national consensus, or an amalgam of nationwide attitude surveys, are unlikely to reflect local needs or concerns. Similarly, from a public education standpoint it is significant that judgments are rooted in knowledge, and that knowledge varies geographically. Therefore it is important for managers to recognize that information strategies should be tailored to local situations and knowledge bases. While it may be more efficient to use standardized, agency-wide resources in public outreach, such approaches are unlikely to be more effective than messages that target local priorities and specific environmental context.

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