Context, Beliefs, and Attitudes toward Wildland Fire Management: An Examination of Residents of the Wildland-Urban Interface

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Abstract

There are a number of benefits from wildland fire such as forest reproduction, habitat improvement, and reduction of threats from insects and diseases. However, along with these benefits are threats to human life, property and air quality. The trade-off between wildfire benefits and costs causes differences in public beliefs about fire management. We surveyed residents of the wildland-urban interface to determine the effects of contextual factors such as location of the forest, its primary use, wildfire history, and current fire conditions on acceptability of prescribed burning, mechanical thinning, and doing nothing. The current condition of the forest was the most important factor influencing support/opposition of management strategies for both individualists and non-individualists. The importance of forest proximity, wildfire history, and forest use depended on the management strategy under consideration and group. Results will help inform land managers in making fire management prescriptions and communicating with the public about those decisions.

Keywords: *attitudes, beliefs, context, prescribed burning, mechanical thinning, values, wildland-urban interface*

Introduction

Across the U.S., past forest management practices, weather patterns and climate, and other conditions have resulted in the potential for wildfires to erupt. In many situations wildfire is an important natural process that allows for the regeneration of vegetation, elimination of disease and insect threats, improvement of wildlife habitat, and reduction of existing fuel loads. However, these potential benefits of wildfire must be considered within the context of potential threats to private property, negative impacts on the harvest of commercial resources, and decrease in air quality and scenic beauty. Since the burning of over 40% of Yellowstone National Park (about 17,000 acres) and the surrounding area in 1988, fire management has become an important issue for both the public and land management agencies. The U.S. Department of Agriculture created the Fire Management Policy Review Team to address concerns about how fires were managed on national parks, forests, and other areas. Although the review team concluded that the effects of fire on the environment were consistent with objectives for wilderness and park resources, policy and planning changes were recommended that emphasized the influence of the public's perceptions on the policy-making process.

Current Wildfire Management

Decades of fire suppression by land management agencies have caused many forests in the U.S. to be overloaded with fuels, resulting in severe wildfire conditions. With recent fire events being particularly costly to private and public property and threatening to human lives, land management agencies have suggested that some burning or removal of fuels from the forest could help put these ecosystems at a lower risk of dangerous wildfire and increase chances to attain a more sustainable fire regime. Two common management actions designed to reduce fuels in the forest are prescribed burning and mechanical thinning. *Prescribed burning* is fire applied to forest fuels on a specific land area under selected weather and fuel conditions to accomplish predetermined management objectives. *Mechanical thinning* involves physically removing selected trees and plants from a

forest based upon a predetermined spacing or pattern technique to decrease the likelihood of large, uncontrollable fires. It may involve heavy equipment (e.g., bulldozers) and/or light equipment (e.g., chainsaws).

Both techniques are considered viable options for removing fuel and reducing wildfire potential. However, as discussed, these options can have both positive and negative impacts on humans and natural resources. The most obvious benefit of fuel load reduction is preservation of the natural forest regime. In terms of negative impacts, prescribed fires can get out of control and cause damage to human life and property. Also, the heavy machinery and road building required for mechanical thinning can detract from a forest's scenic beauty. Because of these contestations, public perceptions of fire management have become an important consideration for agencies charged with managing areas susceptible to wildfire. Understanding the public's perceptions of wildfire management can help agencies recognize when policies might be supported by the public, alert agencies when policies may run into public opposition, and help agencies develop information to garner support for potentially controversial strategies. With public support, the agency can manage more efficiently, spending time and money on the resource, rather than on legal battles and policy adjustments.

Research on Perceptions of Fire Management

Previous research on public attitudes toward wildfire management techniques has focused primarily on prescribed burning. Gardner et al. (1985) found support for flexible fire suppression policies such as prescribed burning, though professionals working in forest management held more positive attitudes toward this practice than did recreation groups and the general public. Gardner et al. (1985) concluded that greater knowledge of fire effects results in the recognition of the positive benefits of prescribed burning. Manfredo et al. (1990) found that a slight majority of residents in Montana and Wyoming supported prescribed burning. However, a national sample found attitudes toward prescribed burning equally divided between support and opposition. Manfredo et al. (1990) found that supporters differed from those that opposed the strategy in the extent to which they believed that prescribed burning would improve conditions for wildlife, destroy natural settings, allow fires to get out of control, destroy scenery, and cause a threat to human life. Jacobson et al. (2001) found general support for prescribed burning in Florida but also found that experience with fire, measured as residential proximity to fire events, was not related to attitudes.

Beyond identifying perceptions of wildfire management, researchers have suggested that education can influence public acceptance of these management strategies (Stankey 1976; Cortner et al. 1984; Taylor and Daniel 1984). Testing this hypothesis, Shelby and Speaker (1990) found that information about prescribed burning increased public acceptance of the practice. Assuming that attitudes toward wildfire management are connected to knowledge and beliefs, Loomis et al. (2001) explored the influence of information on attitudes toward prescribed burning in Florida. They found that providing Floridians with information about wildfire increased knowledge about wildfire benefits and tolerance for prescribed burning.

Much of the human dimensions research on wildfire management identified public knowledge, beliefs, and attitudes toward specific issues related to wildfire management. However, with a few exceptions (e.g., Manfredo et al. 1990), most have been descriptive and focused on perceptions the public holds about wildfire management. A more recent line of research has examined the impact of situational factors, external to the individual, on perceptions of wildfire and its management. Kneeshaw et al. (2004) found that factors such as source of fire (human vs. natural), and potential impacts of fire (on air quality and forest health) influenced respondent perceptions of response to fires and fire conditions. This study expands on that of Kneeshaw et al. (2004) by exploring the concomitant impacts of values, from a theoretical perspective, and external situational factors, or context, on perceptions of wildfire management strategies.

Study Purpose

This study explores the interrelationships among basic and general beliefs related to wildfire, context, and perceptions of prescribed burning and mechanical thinning. We identified segments of the public based on basic beliefs about wildfire management and compared them on general beliefs about and attitudes toward prescribed burning and mechanical thinning. We then compared basic belief groups on the impact of contextual factors on acceptability of prescribed burning, mechanical thinning, and doing nothing in a hypothetical National Forest. The contextual factors included the proximity of the forest to urban areas, the primary use of the forest, wildfire history in the forest, and current fire conditions.

Methods

Sampling and Research Design

A random sample of 1,000 household names, addresses, and telephone numbers was selected from *contiguous counties* (next to a National Forest) and *near-proximate counties* (next to contiguous counties but not next to a National Forest) in the Front Range of Colorado using Survey Sampling, Inc. Consistent with Dillman (2000), an introductory post-

card that described the study was sent to the sample noting that a questionnaire would arrive in the mail, followed by the first mailing of the questionnaire ten days later. Ten days after the first mailing, a reminder/thank you postcard was sent, followed two weeks later by a second questionnaire mailing to those that had still not responded. Of the 1,000 questionnaires mailed, 125 were undeliverable. A total of 376 were returned (43%; 376/875). Two weeks later, a non-response test was conducted by sending a short 2-page version of the questionnaire to a random sample of 250 households that failed to respond to the first questionnaire. This non-response questionnaire included measures of general attitude toward prescribed burning and mechanical thinning and demographics. Of the 250 2-page non-response surveys mailed, 159 were returned (64%).

Factors Measured on the Mail-back Questionnaire. We measured general attitudes toward fire management strategies, basic value-laden beliefs about wildfire, specific beliefs about fire management and the acceptability of specific management actions within situations differing across four contexts.

General attitudes toward fire management strategies. After reading descriptions of prescribed burning and mechanical thinning, respondents indicated, on a 7-point scale, if they thought that each management strategy was extremely, moderately or slightly 1) *foolish or wise*, 2) *ineffective or effective*, and 3) *harmful or beneficial*. The general attitude toward each management strategy was measured as the index of the three items, given scale reliability.

Basic beliefs about wildfire. Using 7-point scales, respondents indicated whether they strongly, moderately, or slightly *agreed or disagreed* with 16 statements designed to measure value-laden beliefs about fire management issues. Four dimensions of basic beliefs were represented by these items. The dimensions included *trust* in government agencies to effectively manage forests, *freedom* for the public to build homes in or near the wildland-urban interface (WUI) without government intrusions, *responsibility* of the homeowner for protecting homes in case of a wildfire, and *responsibility* of the government for protecting homes in case of a wildfire. These items were drawn from research that developed and validated items measuring personal freedom, and responsibility related to wildfire and its management and other research that has continued to apply these dimensions to wildfire issues (Bright et al. 2004; Kneeshaw et al. 2004).

Specific beliefs about fire management. Specific beliefs about wildfire management represent opinions about how fire should be responded to, depending on how it started, its effects on wildlife, wildlife habitat, recreation, and scenery, and the appropriateness of artificial management in forests. Respondents were asked, on a 7-point scale, whether they strongly, moderately, or slightly *agreed or disagreed* with 16 items.

Acceptability of fire management treatments. To measure the acceptability of fire management treatments, respondents were provided with eight scenarios. Following each scenario, respondents indicated, on a 7-point scale, if prescribed burning, mechanical thinning, or doing nothing would be extremely, moderately, or slightly *unacceptable or acceptable*. For each scenario respondents were to consider a National Forest that varied on four contextual factors, selected through discussions with USDA Forest Service research personnel. These factors were not intended to represent all the relevant factors that may influence the acceptability of fire management strategies. These contextual characteristics were:

	Contextual Factors			
Scenario	**Location**	**Primary Use**	**Wildfire History**	**Current Conditions**
1	Near urban area	Outdoor recreation	Little or none	Low likelihood of fire
2	In remote rural area	Commercial activities	Little or none	High likelihood of fire
3	Near urban area	Outdoor recreation	Little or none	High likelihood of fire
4	Near urban area	Commercial activities	Recent history	High likelihood of fire
5	In remote rural area	Commercial activities	Little or none	Low likelihood of fire
6	In remote rural area	Outdoor recreation	Recent history	High likelihood of fire
7	Near urban area	Commercial activities	Recent history	Low likelihood of fire
8	In remote rural area	Outdoor recreation	Recent history	Low likelihood of fire

Note: All contextual factors have 2 levels

Note: Not all possible combinations of factors are represented. It was determined by the researchers that including all of the 16 (4^2) possible combinations of contextual factors as scenarios would have placed too high of a burden on respondents. The purpose of the orthogonal fractional factorial design was to provide the minimum number scenarios with specific attributes that would still allow for an examination of the main effects of the four contextual factors. That minimum number and nature of scenarios is reflected in the eight provided above.

Exhibit 1. Scenario Descriptions by Contextual Factor

1. Location (in a remote unpopulated rural area vs. near a highly populated urban area)
2. Primary use (outdoor recreation such as backpacking, viewing scenery, hiking, and camping vs. commercial activities such as logging and mining)
3. Wildfire history (recent history of forest fire vs. little or no fire history)
4. Current conditions (high likelihood of a fire in the near future vs. low likelihood)

Each of the four factors had two levels, requiring 16 (2^4) scenarios for a full factorial design. An orthogonal fractional factorial design was created to reduce the number of scenarios to eight in order to reduce the burden on respondents.

Analyses

The first step of the analysis was to examine the reliability of general attitudes toward prescribed burning and mechanical thinning as well as specific belief dimensions using Cronbach's alpha and a threshold of $\alpha \geq .70$ (Nunnally and Bernstein 1994). Confirmatory factor analysis was used as a more stringent test of fit of the hypothesized basic belief dimensions to the data since these items were used to identify groups for further analysis. While the basic belief scales have been previously found reliable (Bright et al. 2004; Kneeshaw et al. 2004), they are still undergoing some revision in attempts to more effectively measure specific dimensions. A X^2/df threshold of ≤ 3.0 (Kline 1998) and a *CFI* threshold of $\geq .90$ (Church and Burke 1994), common evaluative statistics employed in confirmatory factor analysis, were used to indicate that the data were an acceptable fit of the model. Object cluster analysis identified segments within the study population based on basic beliefs about wildfire management issues. The criterion variables used in the cluster analysis were the four basic belief dimensions formed from the 16 basic belief statements. Once cluster analysis identified the distinct segments of the study population, independent samples t-tests compared the clusters on basic and specific beliefs as well as attitudes toward prescribed burning and mechanical thinning.

We then determined if the clusters differed in their perceived acceptability of prescribed burning, mechanical thinning, and doing neither across contexts that differed on the four forest characteristics. Conjoint analysis examined the fractional factorial design used to create the eight scenarios. This allowed us to assess the main effects of each of the contextual factors on acceptability of fire management strategies. The two-level factors of location, primary use, wildfire history, and current conditions were independent variables and the acceptability of prescribed burning, mechanical thinning, and doing nothing were the dependent variables. This resulted in the generation of utility scores and averaged importance scores. Utility scores assessed the directional influence of each factor level on the acceptability of the management strategies. Average importance scores for each factor, generated from the utility scores, allowed for the comparison of the relative effects of each factor on the acceptability of a management action. This analysis was conducted for and compared across basic belief groups.

Results

Non-response Tests

Independent samples t-tests found a small, but statistically significant difference in attitude toward prescribed burning between respondents (m = 5.58 on a 7-point scale) and non-respondents (m = 4.95) (t = 3.45, p = .001). There was no statistically significant difference in attitudes toward mechanical thinning between respondents (m = 5.28) and non-respondents (m = 4.93) (t = 1.83, p = .070).

Chi-square analysis examined the difference in demographics between respondents and non-respondents. There was no statistically significant difference between respondents and non-respondents on their reported sex (respondents = 65.9% male vs. non-respondents 67.0% male; $X^2 = .039$, p = .843, Phi = .012). There was a significant difference in education ($X^2 = 23.84$, $p < .001$, Cramer's V = .285). Respondents reported higher levels of education, with 62.3% holding at least a 4-year college degree (35.3% graduate degree) versus 40.4% of non-respondents (14.6% graduate degree). Independent samples t-tests found no significant difference between the two groups on mean age (respondents = 53.77 years old vs. non-respondents = 50.15; t = 1.71, p = .089). Given the significant education difference between respondents and non-respondents, we examined differences in attitude toward prescribed burning and mechanical thinning across education categories, to determine if, ultimately, differences were important. There was no statistically significant education effect on attitude toward prescribed burning (F = 1.488, p = .450) or mechanical thinning (F = .265, p = .932).

Creation and Reliability of Attitude and Basic Belief Indices

Indices were created for attitudes toward prescribed burning and mechanical thinning, specific beliefs about wildfire management, and basic beliefs. Cronbach's alpha was computed for each index to insure that all items within that index measured the same construct (internal consistency), justifying the creation of the index. All attitude scales showed alphas above .85, adequate for use as indices in further analysis (Nunnally and Bernstein 1994). Table 1 pre-

Table 1. Reliability of Specific Beliefs toward Wildfire and Management.

Specific Belief Dimension/Item[1]	Mean	SD	Alpha
Fires endangering wildlife and its habitat should be extinguished.			.826
• If a forest fire is endangering wildlife and its habitat, the fire should automatically be put out.	4.39	1.93	
• It is OK that some wildlife is lost due to forest fire since fire benefits the overall health of the forest.[2]	2.91	1.57	
• The loss of wildlife and its habitat is an acceptable result of allowing natural fires to burn in the forest.[2]	3.22	1.77	
• We should NOT allow wildlife and wildlife habitat to be destroyed by forest fire.	3.44	1.93	
Fires impacting recreation/scenery should be allowed to burn naturally.			.900
• Forest fires should be allowed to burn naturally even if scenery will be destroyed.	3.83	1.90	
• Forest fires should be allowed to burn naturally even if recreation opportunities will be decreased.	3.93	1.90	
• Forest fires should be put out if they are going to decrease recreation opportunities in the area.[2]	4.18	1.77	
• Forest fires should be put out if they are going to destroy scenery.[2]	4.31	1.79	
Fires started by lightning should be extinguished.			.756
• Forest fires started by lightning should automatically be put out.	3.88	1.92	
• Forest fires started by lightning should be allowed to burn as long as they can be controlled.[2]	4.57	1.75	
Fires started by humans should be extinguished.			.712
• Forest fires started by humans should automatically be put out.	5.38	1.75	
• Forest fires started by humans should be allowed to burn as long as they can be controlled.[2]	3.15	1.85	
Manipulating forest conditions to minimize fire is acceptable.			.722
• Forest managers should manipulate forest conditions to decrease the chance of a fire.	5.27	1.55	
• Forest managers have every right to actively manage, or manipulate the conditions of a forest in order to decrease the likelihood of a forest fire.	5.13	1.63	
• We should leave forests alone instead of trying to manipulate their conditions.[2]	3.11	1.84	
• Forest managers should not use artificial measures (e.g., prescribed burning and mechanical thinning) to decrease the chance of a fire in a forest.[2]	2.54	1.60	

[1] Responses to individual items were 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither agree nor disagree, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.

[2] These items were reverse-coded prior to testing reliability and creating the scale.

sents the individual items making up specific beliefs as well as their means, standard deviations, and reliabilities. Reliabilities for all specific belief dimensions were above .70, indicating adequate reliability for the creation of study indices (Nunnally and Bernstein 1994).

Confirmatory factor analysis suggested the hypothesized basic belief dimensions were a good fit of the data (X^2/df = 2.21; CFI = .964). Cronbach's alphas of basic belief dimensions were above .70, lending support to the strong fit of the model (Nunnally and Bernstein 1994).

Creation and Description of Study Groups

Object cluster analysis identified two distinct segments of the study population based on basic belief dimensions, classifying 99.1% of the sample. Then discriminant function analysis determined how well the four basic belief dimensions discriminated among these segments. One discriminant function resulted. Using set correlation, about 84% ($R^2_{x,y}$ = 83.9) of the variance in group membership was explained by the basic belief dimensions. Independent samples t-tests compared the groups on basic and specific beliefs and attitudes toward prescribed burning and mechanical thinning to arrive at a general description of each group (Table 3). Following is a description of each of the two groups based on differences in beliefs and attitudes.

Group 1: Individualist Group. Group 1 showed high agreement with the importance of personal freedom and homeowner responsibility for protecting homes in the WUI and disagreed with the notion of government responsibility. This group only slightly agreed with the notion of trusting the agency to effectively manage forests and wildfire. High agreement with personal freedom and responsibility and low trust in government agencies led us to refer to this group as the *individualist* group. The individualist group supported putting out fires that impact natural resources and recreation/scenery. They slightly agreed that fires started by lightning and humans should be put out. This group moderately agreed that it was appropriate to use artificial means to manage forests and had positive attitudes toward prescribed burning and mechanical thinning.

Group 2: Non-individualist Group. Group 2 disagreed with the notion of personal freedom to build in the WUI and showed a relatively high level of trust in agencies to manage forests and wildfire. This group was neutral on government

Table 2. Confirmatory Factor Analysis on Basic Belief Dimensions.

Basic Belief Dimensions/Items[1]	Beta	Alpha
Trust in land management agencies		.875
• Land management agencies do a good job managing fire in forests.	.613	
• Government land management agencies do a good job managing forests.	.688	
• I trust that government land management agencies know best when planning prescribed burns in the forest.	.668	
• I trust that government land management agencies like the US Forest Service know best when it comes to mechanically thinning the forest.	.819	
• Government land management agencies like the US Forest Service are NOT doing a good job of managing fire in forests.[2]	.696	
• I trust that government land management agencies like the US Forest Service know best when it comes to managing forests.	.883	
Freedom to build and protect homes		.869
• People should be free to build homes near National Forests if they want to.	.886	
• People should be allowed to build homes near forests where the homes could be destroyed by fire.	.879	
• People should not be allowed to build homes near forests where homes could be destroyed by fire.[2]	.679	
• There should be laws against building homes where they could be damaged by forest fire.[2]	.676	
Responsibility of government for property protection		.740
• When people build homes near forests, the government has the primary responsibility to make sure private homes are protected from forest fire.	.741	
• If a fire breaks out in a forest, the agency managing that forest is primarily responsible for making sure that private property is not destroyed.	.422	
• When people build homes near forests, they have the right to expect that their home will be protected form a forest fire by the government agency that manages that forest.	.801	
Responsibility of private homeowners for property protection		.707
• People who build homes near fire-prone National Forests have the primary responsibility for protecting their home from forest fire.	.590	
• When people build homes near forests, it is their own fault if their homes are damaged by fire.	.514	
• When people build homes near fire-prone forests, they should accept they might suffer property losses due to a fire.	.448	
Confirmatory factor analysis statistics [3]	$x^2/df = 2.21$	CFI index = .964

[1] Responses to individual items were 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither agree nor disagree, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.

[2] These items were reverse-coded prior to testing reliability and creating the scale.

[3] Confirmatory factor analyses suggested that data is a good fit of a model if $X^2/df < 3.00$ (Kline 1998) and CI > .900 (Church & Burke 1994).

[4] While this paper describes results based on a Front Range Colorado population, the CFA reported in this table includes all strata used in the original study; Front Range Colorado, Metropolitan Chicago, and Southern Illinois.

responsibility to protect homes (significantly higher than the individualist group) and slightly agreed on homeowner responsibility (though significantly less than the individualist group). Given the low agreement with personal freedom and high trust in government agencies, this group will be referred to, hereinafter, as the *non-individualist* group. The non-individualist group disagreed with putting out fires that impact natural resources or were started by lightning. They were neutral on putting out fires that impact recreation and scenery and agreed with putting out fires started by humans. This group agreed with the use of artificial means to manage forests and had positive attitudes toward prescribed burning and mechanical thinning.

There were no significant differences between individualists and non-individualists regarding their level of education ($X^2 = 5.64$, p = .343), distance of residence from a forest ($X^2 = 8.51$, p = .130), size of current residence ($X^2 = 4.33$, p = .503), and size of residence they were raised in ($X^2 = 6.10$, p = .297). However, individualists were more likely to be male than were non-individualists (72.1% vs. 52.6% male respectively; $X^2 = 12.54$, p = .001) and slightly younger than non-individualists (m = 51.1 vs. 55.3 years of age respectively; t = 2.25, p = .025).

The Effects of Contextual Factors on the Acceptability of Management Strategies

Table 4 presents the results of conjoint analysis for the three management actions and basic belief groups. The utility scores indicate the direction of impact of the levels of each factor on the acceptability of the management actions while the averaged importance score is a standardized measure of the relative strength of the impact of each factor on acceptability. All scenarios showed significant factor effects on the acceptability of prescribed burning, mechanical thinning and doing nothing. We examined the data using both between-group and within-group analysis. The between-group analysis compares the relative effects of the factors on acceptability of each management strategy between the individualist and non-individualist groups. A within-group analysis compares the relative effects of the factors on strategy acceptability of the three management actions within each group separately.

Table 3. Comparison of Study Groups on Basic and Specific Belief Dimensions.

Basic and Specific Belief Dimensions	Mean Scores		t-value	p-value[3]
	Individualists	Non-individualists		
Basic Belief Dimensions[1]				
• Freedom to build and protect homes	5.63	2.44	22.05	<.001
• Trust in land management agencies	4.87	5.77	2.64	.002
• Responsibility of government for property protection	2.90	3.65	2.39	.002
• Responsibility of private homeowners for property protection	5.83	4.99	23.48	.002
Specific Belief Dimensions[1]				
• Fires endangering wildlife and its habitat should be extinguished.	4.18	2.69	6.06	<.001
• Fires impacting recreation/scenery should be allowed to burn naturally.	4.29	3.96	1.53	.129
• Fires started by lightning should be extinguished.	4.87	3.50	2.53	.001
• Fires started by humans should be extinguished.	4.65	5.20	2.13	.009
• Manipulating forest conditions to minimize fire is acceptable.	5.26	5.24	0.11	.909
Attitude Toward Prescribed Burning[2]	5.68	5.50	1.23	.220
Attitude Toward Mechanical Thinning[2]	5.31	5.22	0.49	.623

[1] Mean scores for these dimensions should be interpreted as disagree/agree with the concept. More specifically, they are means for indices of items that were scored 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither agree nor disagree, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.

[2] Attitude scores represent means for indices of items that were scored 1 = extremely foolish/ineffective/harmful, 2 = moderately foolish/ineffective/harmful, 3 = slightly foolish/ineffective/harmful, 4 = neither, 5 = slightly wise/effective/beneficial, 6 = moderately wise/effective/beneficial, 7 = extremely wise/effective/beneficial.

[3] To adjust for the possibility of Type I error in assessing significant differences, Bonferroni's adjustment was applied, resulting in a critical p-value of .005 (.05/11 = .0045).

Between-group Analysis

Context and prescribed burning. For both individualists and non-individualists, the most important factor to influence the acceptability of prescribed burning was current conditions (as indicated by the highest averaged importance for this factor). If current conditions made a wildfire likely, both groups were more likely to support prescribed burning (as indicated by the positive utility score for this factor level). Forest location was the second most important factor. Both groups were more likely to support prescribed burning in rural remote forests than in forests located near an urban area. Recent history of wildfire resulted in support for prescribed burning for both groups. While the order of importance of each factor on support for prescribed burning was the same for both individualists and non-individualists, there was a difference in the directional effects of the primary use of the forest. If the primary use of a forest was for outdoor recreation, individualists were more likely to find prescribed burning acceptable while non-individualists were more likely to find prescribed burning unacceptable. The reverse was true if the primary use was commercial activities.

Context and mechanical thinning. The order of contextual factor effects on support for mechanical thinning was similar for individualists and non-individualists. Current conditions was the most important factor; if a wildfire was likely, then support for mechanical thinning was positive. Support for mechanical thinning in a remote forest was less likely than in an urban proximate forest for both groups. Similarly, both groups' support for mechanical thinning was less likely in forests whose primary use was for outdoor recreation. However, if there was a recent history of wildfire, non-individualists supported mechanical thinning while individualists found it unacceptable.

Context and doing nothing. The current condition of the forest was the most important factor to influence the acceptability of doing nothing in the forest. If current conditions make a wildfire likely, then doing nothing was unacceptable for individualists and non-individualists. The second most important factor for individualists was the location of the forest, where doing nothing was unacceptable for an urban-proximate forest. While recent wildfire history had a stronger influence on support for doing nothing for non-individualists than for individualists, the direction of impact that recent history had on support for doing nothing was the same for both groups: i.e., negative. For both groups, recent wildfire made doing nothing an unacceptable strategy. Use of the forest for outdoor recreation, however, made doing nothing acceptable for the non-individualists but unacceptable for the individualists.

Within-group Analysis

Context and the individualists. For individualists the relative importance of the four factors was the same for all man-

Table 4. Comparison of Utility and Importance of Contextual Factors on Acceptability of Prescribed Burning across Basic Belief Group

Management Strategy/ Contextual Factors	**Individualists**		**Non-individualists**	
	Utility	Averaged Importance	Utility	Averaged Importance
Prescribed Burning				
Location				
• Rural	.1434	27.98	.2475	26.23
• Urban	-.1434		-.2475	
Primary Use				
• Outdoor Recreation	. 0213	16.94	-.0112	16.00
• Commercial	-.0213		.0112	
Wildfire History				
• Recent	.1493	19.46	.2077	23.06
• Little or None	-.1493		-.2077	
Current Conditions				
• Fire Likely	.4978	35.62	.4303	34.71
• Fire Unlikely	-.4978		-.4303	
Mechanical Thinning				
Location				
• Rural	-.2397	21.44	-.1032	19.41
• Urban	.2397		.1032	
Primary Use				
• Outdoor Recreation	-.1088	17.84	-.1127	19.72
• Commercial	.1088		.1127	
Wildfire History				
• Recent	-.1394	19.99	.1332	21.78
• Little or None	.1394		-.1332	
Current Conditions				
• Fire Likely	.6897	40.72	.5430	39.09
• Fire Unlikely	-.6897		-.5430	
Doing Nothing				
Location				
• Rural	.2063	21.66	.0767	20.52
• Urban	-.2063		-.0767	
Primary Use				
• Outdoor Recreation	-.0514	15.63	.0256	18.46
• Commercial	.0514		-.0256	
Wildfire History				
• Recent	-. 0913	20.46	-.1416	23.44
• Little or None	.0913		.1416	
Current Conditions				
• Fire Likely	-.7477	42.25	-.5117	37.58
• Fire Unlikely	.7477		.5117	

Significance of Factor Effects

Individualist Group		Non-individualist Group	
Prescribed Burning	Pearson's R = .991; p < .001	Prescribed Burning	Pearson's R = .980; p < .001
Mechanical Thinning	Pearson's R = .997; p < .001	Mechanical Thinning	Pearson's R = .992; p < .001
Do Nothing	Pearson's R = .991; p < .001	Do Nothing	Pearson's R = .982; p < .001

agement actions. Current conditions were the most important factor, followed by the location of the forest, wildfire history, and primary use. Directional effects are of interest, however. Acceptability of prescribed burning and mechanical thinning is more likely when current conditions support a potential fire. Support for doing nothing is less likely under these conditions. Prescribed burning is more likely to be acceptable in a rural area while mechanical thinning is acceptable in an

urban area. Doing nothing is acceptable in a rural area for individualists. Individualists find prescribed burning and doing nothing acceptable with recent wildfire history but mechanical thinning unacceptable. Finally, if the primary use of the forest is for outdoor recreation, individualists find prescribed burning acceptable and mechanical thinning and doing nothing unacceptable.

Context and the non-individualists. The relative importance of the contextual factors were similar across all management strategies for the non-individualists, except that location was the second most important factor to influence the acceptability of prescribed burning yet it was of virtually equal importance with wildfire history for mechanical thinning and doing nothing. If current conditions suggest a fire is likely, non-individualists found both prescribed burning and mechanical thinning acceptable and doing nothing unacceptable. Similarly, recent wildfire history made prescribed burning and mechanical thinning acceptable and doing nothing unacceptable. If the forest is in a remote rural area, prescribed burning was acceptable to non-individualists, while mechanical thinning was acceptable for this group in urban-proximate areas. Finally, when the primary use of the forest is for outdoor recreation, non-individualists found both prescribed burning and mechanical thinning unacceptable and doing nothing acceptable.

Discussion

We categorized residents of the wildland-urban interface based on their pattern of basic beliefs, or value orientation, and compared the groups on specific beliefs toward wildfire and its management, general attitudes toward prescribed burning and mechanical thinning, and the impacts of contextual factors on support for prescribed burning and mechanical thinning.

Comparing Groups on Beliefs and Attitudes toward Fire Management

Confirmatory factor analysis on the basic belief dimensions supported the theoretical structure of the items, identifying four basic belief dimensions related to forest and wildfire management. These were *trust* in land management agencies, *freedom* to build homes in the wildland-urban interface, *government responsibility* for property protection, and *homeowner responsibility* for property protection. Differences in beliefs between the two groups were both directional and strength related. For example, individualists believed people should be able to build freely in the wildland-urban interface regardless of the potential for fire danger while non-individualists felt there should be limits, including legal regulations, against someone's ability to build a home where it could be impacted by wildfire. Consistent with this notion of personal freedom, individualists agreed more strongly than non-individualists that it is primarily the responsibility of the homeowner to protect their property from fire and disagreed more strongly that it is primarily the role of government to protect private property from wildfire. Non-individualists also showed a significantly stronger trust in land management agencies to manage lands and fires. These differences between the two groups reflect a prominent theme regarding common philosophical differences across society; the importance of individualism and personal freedom versus the role of a strong government. Similar categorizations of values have been found in natural resource based research that examined basic differences among groups (e.g., Bright and Burtz 2006). In examining specific beliefs held by the two groups, a second theme arises, that of support for natural processes. Non-individualists more strongly opposed extinguishing fires that were started by lightning, and endangered wildlife and its habitat. On the other hand, individualists supported extinguishing fires in both of these situations.

While the differences among the two groups based on basic beliefs make intuitive sense, it is important to point out that these belief dimensions are not exhaustive of those that might exist regarding forest and wildfire management, and in fact, may not always be the best dimensions to use regarding natural resource and wildfire related issues. However, these represent key value-based dimensions that might influence more specific attitudes toward actions such as prescribed burning and mechanical thinning across a variety of contexts. In addition, the nature of the two groups identified in this study population is limited to the four basic belief dimensions used to create those groups. Other basic belief dimensions may correlate with more specific perceptions, and better predict specific attitudes and behaviors. Regardless, that the orientation of one's values related to natural resources and resource management can influence more specific perceptions and behaviors is supported by a great deal of research (e.g., Dietz et al. 1998; Fulton et al. 1996; Homer and Kahle 1988; McFarlane and Boxall 2000; Stern and Dietz 1994; Stern et al. 1995; Vaske and Donnelly 1999; Vaske et al. 2001).

The Relative Importance of Contextual Factors on Support for Fire Management Actions

While there were differences between the individualists and non-individualists in basic and specific beliefs about wildfire management, the two groups were very similar in their overall support for prescribed burning and mechanical thinning. It was, therefore, instructive to explore potential differences in perceptions of fire management across different contexts such as the location, primary use, wildfire history, and current conditions of a forest.

For both groups the current conditions of the forest was the most important factor determining support or opposition to prescribed burning, mechanical thinning, and doing nothing at all. If current conditions of a forest make a wildfire likely it is apparent that the public would support the land management agencies in taking action to mitigate or eliminate the potential effects of those fires, whether that is to set prescribed burns or engage in mechanical thinning. Either way, doing nothing in these two situations is not acceptable to a large proportion of the public. This is not surprising since the current condition of a forest is among the most direct factors that presage an imminent wildfire. Therefore, management agencies providing information to justify an increase in prescribed burning or mechanical thinning should focus first on the fact that conditions of the forest support a wildfire and that management action would likely improve those conditions.

The relative importance of wildfire history, location of the forest, and primary use varied somewhat across management action and group and were always less important than current conditions. There were interesting findings regarding these contextual factors however. For example, our finding that both groups are less likely to support prescribed burning in areas with little or no recent wildfire history suggests that people may interpret a lack of recent wildfires as an indication of a lower fire hazard. In many locations this is unlikely to be an accurate assessment and could hinder appropriate management actions in areas where there has not been fire, or that fire has been suppressed, and prescribed burning and/or mechanical thinning are warranted.

The location of the forest was usually the second most important factor influencing support or opposition to prescribed burning and mechanical thinning (though non-individualists had it virtually tied with primary use and wildfire history). Both individualists and non-individualists preferred the use of prescribed fire in remote, rural areas and mechanical thinning in urban-proximate areas. The perception that prescribed burning in rural forests directly impacts people less may have played a role in this acceptability and the unacceptability of prescribed burning near urban areas. Similarly, a forest in a rural area decreased support for mechanical thinning. This may have been due to either a preference for prescribed burning in rural areas or opposition to the use of obtrusive man-made approaches in forests that are away from civilization and therefore able to provide more primitive experiences. Moreover, mechanical thinning may have been perceived as being less dangerous to the public than prescribed burning in forests that are near urban areas.

Implications

Implications of identifying differences in preferences across value groups lie in greater understanding of the values that individuals hold toward natural resource and fire management. While there were similarities in how the groups in this study perceived prescribed burning and mechanical thinning in general, there were some contextual differences. Several benefits accrue by gathering this value information. First, land managers intuitively understand that many different opinions exist about appropriate natural resource management, and specifically fire management. Broad-based value information can provide an efficient summary of the diversity of values toward natural resource and fire management that exist in a region and enhance the manager's understanding of the nature of an important component of their constituency.

A second benefit from understanding the diversity of values that exist is that managers can use this information to make educated assessments of how different segments of the public feel about issues such as prescribed burning and mechanical thinning. This would provide a "heads-up" regarding when and from whom conflicts may arise when managers seek to adhere to existing resource management policies.

A third benefit of value information is assistance for managers in developing more efficient communication programs. Information about prescribed burning or mechanical thinning programs can be designed to not only inform the public about what the agency is planning, but also to speak to the values different segments of the public hold, emphasizing how their values are consistent with management policies and actions.

An important implication is that if different segments of the public, defined by natural resource-related values, exist, managers may consider a market segmentation approach to thinking about their publics. This does not imply that managers need to identify individuals that hold different values and beliefs related to wildfire management and provide them directly with specific information. Though desirable and effective, such a "target segmentation" strategy is not always feasible or necessary in areas where a number of different "value orientations" exist, unless such differences in values could be identified geographically or by other specific sociodemographics. This applies in situations such as that found in this study, where there were no differences between the value-based groups in their levels of education or proximity of residence to a forest. Differences in gender and age, while statistically significant, were not likely of the magnitude where those differences could be easily taken advantage of in a traditional target segmentation approach. An alternative marketing strategy called "product differentiation," or in this case "message differentiation" could be used where different target segments exist, but the ability to reach these groups through different media is deemed infeasible or un-

necessary. Providing information relevant to different value-defined groups in media that reach everyone, such as newspapers, or inviting the public to events that provide broad-based information, can be effective in disseminating specific information to a value-diverse population that desires it and can put it to use in forming their opinions.

While contextual differences between the value-based groups on support for fire management existed, there is also likely to be between-context differences in specific beliefs about the tenability of fire management strategies. This difference in beliefs across contexts and value-groups makes for complex decisions on the mode and content of messages.

Finally, attitudes toward wildfire are contextual, and the complexity of factors that influence public perceptions shows the importance of creating information campaigns that describe the fire science around wildfire management and decision-making. Results of this study showed that many factors may impact support for these management actions. Communicating the environmental and geographic context of wildfire management decision-making may help public land management agencies garner support for fire management decisions. Recognizing the importance of adequate information in a proactive manner allows agencies to create educational programs that explain the context of the decision and let the public know when prescribed burning and mechanical thinning are most appropriate and necessary. With public support, the agencies can be more efficient, spending more time and money on the resource, as opposed to legal battles and policy adjustments dictated by the courts, interest groups, or battles for positive public opinion. Regardless of the strategy for providing information, understanding constituent perceptions through research, such as this, is one component of improved integration between managers and the public.

Endnotes

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