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ANTECEDENTS TO ATTITUDES TOWARD PRESCRIBED BURNING, MECHANICAL THINNING, AND DEFENSIBLE SPACE FUEL REDUCTION TECHNIQUES

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ABSTRACT.—As fire policy and management take on a greater role in land agencies, a better understanding is needed of public opinion, particularly of homeowners who are most affected by wildland fires. This research assessed homeowners' attitudes toward three fuel management approaches—prescribed burning, mechanical fuel reduction, and defensible space ordinances—in three areas of the United States (California, Florida, and Michigan). Although attitudes varied for the management approaches across regions, most were positive. The personal importance of each fuel treatment and overall trust in the government managing public lands were found to be related to the direction (positive, neutral, negative) of the attitude held toward the fuel treatment.

Across the United States, particularly in rapidly growing wildland-urban interface (WUI) areas of the West, the coexistence of people and the ecosystems in which they live is under increasing stress. One stressor in the wildland-urban interface areas is the threat of wildland fire (Cohen 2000, Davis 1990). Wildland fires can be ignited by humans, for example, through arson, escaped campfires, discarded cigarettes, or backyard burning of garbage. Wildland fire can also result from lightning strikes. Today more people live and recreate in areas prone to wildfires, thus fire protection is in greater demand. Enormous expenditures, mostly Federal, but also State and local, are devoted to fire protection with taxpayers bearing these costs.

Survey research conducted at State or regional scales has assessed public opinion about fire and fuels management. Schindler and Reed (1996) found more support for mechanical thinning than for prescribed burning with residents of northeast Oregon's Blue Mountains. Winter (2002) recently found that California residents were supportive of letting some fires burn, but were more supportive (by a factor of two) of protecting residences than extinguishing all fires regardless of cost. Loomis *et al.* (2001) found that residents of central Florida were supportive of prescribed burning and that a greater proportion of residents held more positive attitudes after receiving public education materials on prescribed burning than those not receiving information.

Fewer studies have targeted residents living in or adjacent to wildland areas where significant financial resources are spent on fire protection and risk reduction. In a study of homeowners in Crawford County, Michigan, Winter and Fried (2000) found support for mechanical fuel reduction on public lands and weak support for defensible space practices and prescribed burning. Also reported in their study was the notion that land agencies and homeowners should share responsibility for fire risk reduction because fuel reduction efforts do not, by themselves, guarantee that a wildfire will leave private property and homes undamaged. It is in these WUI areas, where home construction continues, that fire and resource managers face the greatest challenges. The opinions of WUI homeowners, those who face the possibility of losing their lives, homes, and belongings in a wildfire, influence the political environment confronting managers charged with achieving a balance between allowing natural processes to occur and protecting homes and lives.

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To assess and understand attitudes held by homeowners in WUI areas, we used the theory of reasoned action (Ajzen and Fishbein 1980) as a framework for measuring beliefs about, attitudes toward, and intentions to support fuel management approaches in WUI areas. Others have used and extended this theory by considering ancillary factors that influence the primary components of the reasoned action model. In a study of hunters, Rossi and Armstrong (1999) found that past experience with hunting explained significant variation in intention to hunt. Bright and Manfredo (1995, 1997) reported that personal relevance moderated the effect information had on people's attitudes toward natural resource management. At high levels of personal relevance of an issue, information had a greater effect on attitudes. At low levels of personal relevance, information had a less central role in changing attitudes. Bright *et al.* (1993) found that visitors to Yellowstone National Park responded differently to communications targeted to change beliefs, attitudes, and intentions for controlled burning depending on their initial attitude direction (positive, negative). The communication message was more effective in altering cognitive responses of visitors who initially held positive attitudes than of those visitors who initially held negative attitudes toward controlled burning in the park.

During focus group interviews with wildland-urban interface homeowners in California, Florida, and Michigan, trust in forest management agencies emerged as an important factor in the decision to support or oppose fuel management approaches (Winter *et al.* 2002). These observations conformed primarily to the "competence" dimension of social trust wherein "trust is gained only when the individual or institution in a social relationship is judged to be reasonably competent in its actions over time" (Kasperson *et al.* 1992). In their study of support for the siting of a nuclear waste repository among Nevada residents, Flynn *et al.* (1992) found that the level of trust in those responsible for repository management directly influenced risk perceptions, which, in turn, directly affected attitude toward the repository.

In this study, we assessed attitudes toward three fuel management approaches in WUI areas in California, Florida, and Michigan. We tested the statistical dependence of attitudes about fuel management approaches on 1) past experience with the fuel management approach, 2) personal importance of the fuel management approach, and 3) overall trust in land managers' capacity to carry out fuel management effectively and safely. The intention of this analysis was to assess the feasibility of extending the reasoned action model, as applied to fire management, to better predict the antecedents to a homeowner's intention to support the implementation of each fuel management approach where they live.

METHOD

Site Selection

Our research design targeted several areas of the United States to illuminate regional variation. The purpose of the study is to provide land management agencies an assessment of homeowners' opinions about fuel management approaches. Prior to collecting data on large samples of homeowners in the selected study sites, we conducted focus groups with homeowners and agency managers at four sites in three states that offered substantial diversity (results reported in Winter *et al.* 2002). In addition to these sites, a dozen other areas were considered as possible study sites on the basis of fire history, population density, wealth demographics, type of ecosystems, and current fuel treatment norms. Clay County, in north central Florida, and Oscoda County, in the northern Lower Peninsula of Michigan, were selected for inclusion in the focus group and the mail questionnaire stages of the research. El Dorado and Placer Counties in the central Sierra foothills of northern California were selected for inclusion in the mail questionnaire only. The Michigan survey site was expanded to Crawford and Ogemaw Counties to ensure that the survey targeted homeowners subject to wildland fire risk.

Study Site Descriptions

The California study site contains a mix of oak woodland, pine, and mixed conifer forests, with much of the forested wildland managed by the USDA Forest Service (El Dorado and Tahoe National Forests). Wildfires are frequent (several hundred per year), and prescribed burns are rare and very limited in scope and size. Defensible space ordinances are enforced by the California Department of Forestry and Fire Protection. The Florida site contains primarily pine forest and is almost entirely under private

ownership (i.e., wood product companies). The Michigan site contains primarily jack pine forests. Both Federal- (Huron Manistee National Forest) and State- (Au Sable State Forest) managed forests exist in the area. There are moderately frequent wildland fires and prescribed burns. In Florida and Michigan, unlike California, defensible space was not a local or State ordinance.

Data Collection Procedures

Data were collected in a mail questionnaire in fall 2001 (California and Florida) and spring 2002 (Michigan). Homeowner lists were obtained from county tax assessors at each study site. For California and Florida, GIS data for parcels and natural features were available to assist in selecting the samples. For Michigan, more spatially coarse techniques were used to identify areas where homeowners face the risk of wildfires. In all three states, extensive discussions were held with Federal and/or State agency foresters and fire managers to refine our area selection. Thus, our sample represents specific areas of each county where homeowners and potentially flammable vegetation fuels were present. Only properties for which tax assessor records indicated the presence of a structure with a value of at least $10,000 were treated as part of the population of interest (to eliminate vacant lots). In all areas, single family homes and mobile homes were considered to belong to the population of interest. In California and Florida, a sample was created using geographical cluster sampling with random offsets to ensure adequate sample sizes for each geographical separation class for a related geostatistical study of spatial continuity in fuel management acceptance. In Michigan, the budgeted sample size matched the identified population so that all homeowners in the population of interest were surveyed.

A modified Dillman (1978) mail procedure was used whereby each household in the sample received an initial mailing comprised of a personalized letter, business reply envelope, and a questionnaire. A reminder postcard was sent 1 week later. Three weeks after the initial mailing, nonrespondents were sent a packet similar to the first mailing. In California and Florida, approximately 1,200 homeowner households were sampled; in Michigan, where a larger budget was dedicated to the homeowner survey, approximately 2,400 households were sampled (table 1). The highest response rate was received in Michigan with 53 percent, followed by California with 49 percent and Florida with 31 percent.

Measurement and Data Analysis

The questionnaires used at each site were identical except for the description of the area of interest, were critiqued by several fire researchers and fire managers, and were pretested with focus group participants (who were contacted after our initial focus groups) before survey work began. The questionnaire was printed in a booklet form that included a cover page showing a map of the local area, an introductory page containing directions and definitions of the three fuel management approaches, and six pages of questions. Questions were designed to assess past experiences with wildfire and fuel management approaches, length and type of residency, personal importance or relevance of each fuel treatment, attitudes toward each fuel treatment, trust in land managers carrying out fuel treatments, and descriptive social and demographic attributes. All the opinion-type questions (e.g., attitudes, importance, trust) used seven-point scales so that respondents could express the degree to which they were positive (important; agreed) or negative (not important; disagreed).

Table 1.—*Sample sizes and response rates for each study site*

Study sites	Original sample size	Bad addresses	Effective sample size	Respondents	Response rate
	Frequency				*Percent*
California	1,200	90	1,110	544	49
Florida	1,197	54	1,143	357	31
Michigan	2,453	101	2,352	1,253	53

In the fuel treatment section, prescribed burning was defined as: "also called controlled burning, this practice can involve allowing a naturally caused fire to burn under close and careful watch; or intentionally setting fires in ways that can be controlled to produce desired conditions and protect against undesirable conditions." Mechanical fuel reduction was defined as: "these methods vary widely. Resource managers can use chainsaws, brush mowers, or other specialized machines to reduce the number of shrubs and small trees where they are so numerous that they increase the risk and size of wildfires." Defensible space ordinance was defined as: "this approach requires homeowners to create and maintain a fire-safe zone around their homes by removing flammable vegetation within 30 feet of their home. It would also require that yard trees and shrubs be no closer than 15 feet apart and that the lower limbs of trees be pruned to a height of 15 feet from the ground or greater." Personal relevance was considered as a construct to measure the salience or attention an individual has to fuel management approaches. Based on pretesting of various scales and question/response wording, an importance scale was selected as the means of assessing an individual's psychological "attention" to fuel management approaches. Importance of each of the three fuel management approaches was framed with the following question introduction: "Governments have programs or ways of improving communities and quality of life. Not all of these programs have the same importance to citizens. How important are these programs to you personally as they are practiced in your local area?" The question on trust in government resource agencies was framed as "how would you rate the government agencies that manage wildland in (local area specified)."

Analysis for this paper used primarily descriptive and bivariate analyses to explore possible relationships between variables and patterns across the three study sites and fuel management approaches. After presenting the attitude mean scores, we reduced the seven-point attitude scales to three groups (positive, neutral, and negative) to simplify the presentation of the results. Bivariate analyses included Pearson Chi-square, an appropriate test for ordinal and nominal data, and univariate analysis of variance for categorical variables and seven-point interval scales. For all significance tests, a $p<.05$ level was used to assess significance.

FINDINGS

Description of Respondents

California and Florida respondents were primarily permanent residents who lived in their homes 12 months a year (table 2). Four out of 10 Michigan respondents were seasonal or vacation homeowners. A majority of all respondents had lived longer than 10 years in the area being studied. Males were more likely to be respondents to the mail survey. California and Michigan respondents had higher levels of education than respondents from Florida. Florida respondents had the lowest household income levels and California had the highest.

Descriptive Results of Fuel Treatment Attitude, Past Experience, Personal Importance, and Trust in Government Agencies

Respondents from the three study sites held different attitudes toward each of the fuel management approaches. California respondents held strong positive attitudes toward mechanical fuel reduction (mean=5.8 on seven-point scale) on public land and defensible space ordinances (mean=5.8) for their own property (table 3). Florida respondents held a strong positive attitude toward prescribed burning (mean=5.7). Michigan respondents, on average, were neutral on all three fuel management approaches with mechanical fuel reduction rated slightly positive (mean=5.0). To carry out the remaining analysis, we collapsed the seven points into three groups—positive (5, 6, and 7 on the scale), neutral (4), and negative (1, 2, and 3). Similar to the mean results, California homeowners were positive (modal category) on all three fuel management approaches (table 4). Florida homeowners were also positive (mode) on all three fuel treatment approaches, but less than 50 percent of the respondents were positive on defensible space. Michigan homeowners were also positive (mode) on all three fuel treatments, but only with mechanical fuel reduction techniques were more than 50 percent of the respondents positive.

Respondents also reported very different past experiences with each of the fuel management approaches. California respondents had extremely high levels (91 percent) of experience actually removing flammable vegetation with

Table 2.—*Description of respondents*

	California (n=544)	Florida (n=357)	Michigan (n=1,244)
		Percent	
Type of residency			
Permanent	89	97	60
Seasonal	7	1	38
Other	4	2	2
Residency length			
1-10 years	40	33	32
11 years or more	60	67	68
Gender			
Male	70	60	71
Female	30	40	29
Household income levels			
Less than $40,000	23	33	34
$40,000 to $79,999	45	49	37
$80,000 or more	32	18	29
Highest education attainment			
High school	26	45	35
Some college	38	39	33
College graduate	36	16	32

Table 3.—*Attitudes toward fuel management approaches for three study sites*

Fuel management approach	California	Florida	Michigan
		Mean[1] (Standard deviation)	
Prescribed burning	5.1 (1.7)	5.7 (1.4)	4.0 (1.9)
Mechanical fuel reduction	5.8 (1.3)	5.3 (1.5)	5.0 (1.6)
Defensible space	5.8 (1.6)	4.3 (1.9)	4.2 (2.0)

[1] Scale where 1 represents extremely negative, 4 represents neutral, and 7 represents extremely positive.

Table 4.—*Attitudes (grouped) toward fuel management approaches for three study sites*

Fuel management approach	California			Florida			Michigan		
	Pos.[a]	Neut.	Neg.	Pos.	Neut.	Neg.	Pos.	Neut.	Neg.
					Percent				
Prescribed burning	66	18	16	78	17	5	42	23	36
Mechanical fuel reduction	79	17	4	64	28	8	57	29	14
Defensible space	79	13	8	42	30	28	42	27	32

[a] Attitude scale was categorized into three groups: positive attitude (points 5, 6, and 7 on the scale); neutral (4 or midpoint), or negative attitude (points 1, 2, and 3).

only 32 percent indicating that they were required to remove flammable vegetation (table 5). Two-thirds of the California respondents had experienced smoke discomfort from wildfires and about 2 in 10 homeowners had experienced either a prescribed burn or a mechanical fuel reduction near their home. Florida respondents were most likely (61 percent) to have experienced smoke discomfort from wildfires, followed by removing flammable vegetation (44 percent). A greater proportion (31 percent) of Florida respondents had experienced prescribed burning near their home than California (25 percent) or Michigan respondents (21 percent). Michigan respondents had the lowest level of smoke discomfort from wildfires (possibly because of the high number of part-time residents who do not use their seasonal home during spring and fall prescribed burns).

The personal importance of each of the three fuel management approaches had quite similar results to the attitude scales. California respondents rated mechanical fuel reduction and defensible space equally (very important). Florida respondents rated prescribed burning as very important. Michigan respondents rated mechanical fuel reduction as the most important of the three fuel management approaches.

The highest level of trust was described as "the government doing a good job of protecting private property from wildland fires" (table 6). California respondents had the highest rating on this scale (mean of 5.2 on a seven-point agreement scale), followed by Florida (mean=4.9) and Michigan (mean=3.9). The other scale items measuring trust were rated, on average, at a neutral level. Florida homeowners were slightly more trusting (mean=4.5) of the use of prescribed burning than California (4.1) or Michigan (3.3) homeowners, although California homeowners gave agencies a higher trust score on notifying the public about upcoming prescribed burns than Florida or Michigan homeowners.

Table 5.—*Experience with and personal importance of fuel management approaches for three study sites*

	California	Florida	Michigan
		Percent	
Past experience with			
Prescribed burning near home	25	31	21
Smoke discomfort from wildfires	68	61	17
Mechanical fuel reduction near home	21	5	9
Required to remove flammable vegetation on property	32	2	2
Actually removed flammable vegetation on property	91	44	42
		Mean (Standard deviation)	
Personal importance of[a]			
Prescribed burning	5.2 (1.7)	5.8 (1.3)	4.6 (1.9)
Mechanical fuel reduction	5.7 (1.4)	5.4 (1.5)	4.9 (1.7)
Defensible space	5.8 (1.6)	4.5 (2.0)	4.4 (2.0)

[a] Scale where 1 represents not at all important to 7 represents extremely important.

Table 6.—*Level of agreement with statements about trust in the government agencies that manage wildland for three study sites*

Trust statements[a]	California	Florida	Michigan
	- - - - *Mean (Standard deviation)* - - - -		
I trust the government to make the proper decisions about the use of prescribed burning.	4.1 (1.8)	4.5 (1.7)	3.3 (1.8)
The government does a good job of notifying the public about upcoming prescribed burns.	4.0 (1.7)	3.6 (1.7)	3.4 (1.7)
I trust the government to make the proper decisions about the use of mechanical fuel reduction.	4.2 (1.6)	4.1 (1.6)	3.5 (1.7)
I trust the government to make the best decision about enacting and enforcing defensible space ordinances.	3.9 (1.7)	3.6 (1.8)	3.0 (1.7)
The government does a good job in managing public land.	3.9 (1.5)	4.1 (1.5)	3.5 (1.6)
The government does a good job communicating to the public about forest issues.	3.6 (1.6)	3.7 (1.6)	3.0 (1.6)
The government does a good job of protecting private property from wildland fires.	5.2 (1.5)	4.9 (1.5)	3.9 (1.7)

[a] Scale where 1 represents strongly disagree, 4 represents neutral, and 7 represents strongly agree.

Bivariate Analysis of Attitudes Toward Fuel Management Approaches and Possible Explanatory Variables

Homeowners in the selected study areas of California and Florida had approximately the same frequency of past experience with each of the fuel treatments regardless of whether they held a positive, neutral, or negative attitude toward that fuel treatment (table 7). In California, a pattern was observed where respondents with a positive attitude toward defensible space ordinances were more likely (93 percent of those with positive attitude) to have actually removed flammable vegetation from their property in comparison to those with a neutral attitude (89 percent of those with neutral attitude removed vegetation) and a negative attitude (77 percent of those with negative attitude removed vegetation).

In Michigan, attitude levels were more closely related to past experience with fuel treatments. Respondents with negative attitudes toward prescribed burning were more likely to have had a prescribed burn occur near their home (30 percent of negative attitude respondents experienced prescribed burn, 17 percent of positive, and 14 percent of neutral) or had discomfort from smoke caused by wildfire (23 percent of negative attitude respondents experienced smoke discomfort, 14 percent of positive, and 13 percent of neutral) in comparison to

respondents who held a neutral or positive attitude toward prescribed burning (table 7). Similar to California respondents, Michigan respondents with a positive attitude toward defensible space ordinances were more likely (53 percent of those with positive attitude) to have actually removed flammable vegetation from their property in comparison to those with a neutral attitude (36 percent) or a negative attitude (34 percent).

Respondents with a positive attitude toward any of the three fuel management approaches were significantly more likely to rate the personal importance of the fuel approaches as being more important in comparison to those who held neutral or negative attitudes toward a fuel approach (table 7). This pattern was found across all three fuel treatments in each of the study site areas.

Finally, the level of trust in the government to manage wildland was found to be higher amongst those with positive attitudes toward any of the three fuel management approaches across the three study sites (table 7). Respondents with negative attitudes toward the fuel treatment approaches disagreed, on average, that the government can effectively manage wildland including wildfire, prescribed burning, mechanical fuel reduction and defensible space ordinances.

DISCUSSION

The results from the three areas studied suggest that attitudes toward prescribed burning, mechanical fuel reduction, and defensible space ordinances differ in various parts of the United States. For all three areas and fuel management approaches, the greatest number of respondents held positive attitudes. However, sizable segments of homeowners held neutral or negative attitudes about one or more fuel management approach. In both Florida and Michigan, 58 percent of respondents held either neutral or negative attitudes about defensible space ordinances, and in Michigan, 58 percent of respondents were neutral or negative towards prescribed burning, too.

Based on the theory of reasoned action, we would expect beliefs to be a strong predictor of attitudes and attitudes to be a strong predictor of intentions (i.e., to support a fuel treatment approach). Other researchers using this theory to explain public support and actions have found that additional social science variables (e.g., subjective norms, personal relevance, perceived behavioral control) helped predict attitudes, intentions or behaviors. Our results show that personal importance is a good predictor of attitude groups (i.e., positive, neutral, negative) across all three fuel management approaches and study areas. Overall trust in the government to manage wildland was also a good predictor of attitudes particularly in understanding homeowners with a negative attitude toward a fuel management approach. Past experience with a fuel management approach was not universally a good predictor of attitude levels. In California and Michigan, homeowners who actually practiced defensible space on their property were more likely to hold positive attitudes toward defensible space; however, there were still homeowners who practiced defensible space (with an ordinance in effect) and did not approve of it as a government policy.

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Table 7.—*Bivariate relationships between attitude toward each fuel management approach and past experience, personal importance, and overall trust in government for three study sites*

Explanatory variables	Attitude	California				Florida				Michigan			
		Pos.[a]	Neutral	Neg.	Sign[b] test	Pos.	Neutral	Neg.	Sign test	Pos.	Neutral	Neg.	Sign test
		- Percent yes -				- Percent yes -				- Percent yes -			
Past experience with													
Prescribed burning near home	PB	26	20	29	ns	35	18	28	s*	17	14	30	s***
Smoke discomfort from wildland fires	PB	66	65	79	ns	61	57	67	ns	14	13	23	s***
Mechanical fuel reduction near home	MFR	24	5	32	s***	8	2	0	ns	11	5	11	s**
Required to remove flammable vegetation on property	DS	33	37	23	ns	1	3	0	ns	2	2	1	ns
Actually removed flammable vegetation on property	DS	93	89	77	s**	47	36	46	ns	53	36	34	s***
		- - Mean - -				- - Mean - -				- - Mean - -			
Personal importance of[c]													
Prescribed burning	PB	5.0	4.4	3.3	s***	5.7	4.4	2.7	s***	5.5	4.2	3.7	s***
Mechanical fuel reduction	MFR	6.1	4.6	3.8	s***	6.0	4.4	4.0	s***	5.6	4.1	3.8	s***
Defensible space	DS	6.3	4.5	2.7	s***	6.1	4.8	4.5	s***	5.7	4.2	3.0	s***
Trust[d]													
Overall trust in government	PB	4.4	4.1	3.1	s***	4.3	4.3	3.5	s***	3.9	3.5	2.7	s***
Overall trust in government	MFR	4.2	4.0	3.3	s***	4.2	4.1	3.6	s**	3.6	3.3	2.9	s***
Overall trust in government	DS	4.2	3.9	3.4	s***	4.2	4.0	3.2	s**	3.6	3.4	3.0	s***

[a] Attitude was categorized into three groups: positive attitude (points 5, 6, and 7 on scale); neutral (4 or midpoint), or negative attitude (points 1, 2, and 3).

[b] s=the statistical test estimated a $p<.05$ level of association between the variables with * at $p<.05$, ** at $p<.01$, and *** at $p<.001$.

[c] Scale where 1 represents not at all important to 7 represents extremely important.

[d] Mean of the seven trust items, including items measuring each of the three fuel management approaches, where the values could range from 1 representing the government as very untrustworthy of managing wildland to 7 representing the government as very trustworthy. Cronbach's α

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