

AN ANALYSIS OF HOMEOWNER AND AGENCY WILDLAND FIRE MITIGATION STRATEGIES

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Abstract

Four homeowner and agency wildland fire mitigation strategies were empirically examined in relation to three sets of causal influences. Two agency actions (prescribed fire and mechanical thinning) and two homeowner actions (defensible space and firewise construction) were analyzed against socio-demographic, situational and psychological precursors. Data were from a survey of Colorado residents ($n = 532$) living in the wildland-urban interface. Logistic regression indicated that the agency and homeowner actions had significantly different patterns of social causes and linkages. Results support the contention that socio-demographic, situational and psychological variables differentially influence support for agency or homeowner actions. Overall, the psychological measures were the most useful. Theoretically based models of natural resource policies can facilitate understanding the causal mechanisms that drive support for, or opposition to, wildland fire actions and improve policy development, situated communications and local community involvement strategies.

1.0 Introduction

Recent catastrophic wildfires have reinforced the need for successful mitigation strategies that are coordinated across all levels of government (federal, state, county, local) and address the needs and concerns of affected homeowners living in the wildland-urban interface (WUI) (Blackwell 2004). Despite the growing body of social science literature on wildland fires, however, knowledge gaps remain. For example, to what extent are homeowners' familiar with, and approve of, alternative agency initiated wildfire mitigation strategies (e.g., mechanical thinning, prescribed burns)? Are WUI

residents willing to adopt individual behaviors that can potentially minimize the consequences of a wildland fire (e.g., defensible space, firewise construction)? Do they consider these activities effective? Do homeowners feel that defensible space and firewise construction make their property safer? What influences individual behavior and support for wildland fire mitigation strategies? Managers need a better understanding of the mechanisms involved to improve wildland fire policy and associated communication strategies.

1.1 Background

Natural resource managers have recognized that the social sciences can be used to inform policy with good information (O'Laughlin 2003). For example, Cheng (2002) emphasized that responding to wildfire risks is essentially a "social process that blends scientific information with social values and attitudes." Hoover and Langner (2003) noted "the importance of understanding ...attitudes, perceptions and beliefs about fire in developing feasible fire management strategies." Despite this recognition of the potential contributions that the social sciences can make, scientifically-based analyses of wildland fire policies are only starting to emerge in the literature (Cortner & Field 2004).

Merging science and policy goes back to the founder of policy sciences, Harold Lasswell, who noted that a healthy policy process "brings to light factors that hitherto operated as a determining factor,...but which had been operating unconsciously" [i.e., unknown to the policy maker] (1951: 524). Work in other policy arenas underscores this approach and has suggested the importance of linking normative beliefs and public policy issues, particularly with empirical data (Hyman, Shingler, & Van Loon 2001). Research on social norms has also supported the integration of science and application. Over the past three decades, at least 50 studies have examined norms (evaluative standards) toward natural resource management issues (for reviews see Shelby & Vaske 1991; Shelby, Vaske, & Donnelly 1996; Donnelly, Vaske, Whittaker, & Shelby 2000;

Vaske & Whittaker 2004). As applied to this study, such evaluative standards refer to the support for collective or institutional behaviors (e.g., an agency's policy regarding fire management). Other research suggests that successful implementation of different policies may rely upon combinations of factors particular to that policy (Taylor, Carpenter, Cortner, & Cleaves 1988; Wittmann, Vaske, Manfredo & Zinn 1998; Zinn, Manfredo, Vaske, & Wittmann 1998). It is, therefore, important to study policy-related norms in a known context, with explicit reference to both geographic place and underlying situations that influence the measured state.

1.2 Context Variables

Socio-demographic variables are commonly measured in social science surveys, and are frequently reported in wildland fire management studies. Variables such as age, sex, education and income have been shown to be related to residents' perceptions wildland fires. Otani and others (1992) showed that older residents were more cautious in their interpretation of warning signs. A review of risk perception studies concluded that gender played a significant role and suggested that different meanings are socially constructed rather than genetically predetermined (Gustafson 1998). Education may be linked to knowledge about wildland fire and income may constrain homeowner mitigation strategies (e.g., firewise construction) (Vogt, Winter, & Fried 2005).

Situational factors define a given context and influence what the public perceives as acceptable or feasible (Wittmann et al. 1998, Zinn et al. 1998). Large tracts of forested land often surround homes built in the wildland-urban interface. Protecting these private residences from fire is a primary consideration when managing wildland fires. This protection influences homeowners' acceptance of fire management policy (Davis 1990). Public support for fire management has been linked to whether the fire will affect private property (Jacobson, Monroe, & Marynowski 2001; Manfredo, Fishbein, Haas, & Watson 1990). In areas where property damage from wildfires occurs frequently, residents supported the immediate suppression of fires that threatened personal property (Gardner, Cortner, & Widaman 1987).

Studies of wildland fire beliefs and attitudes suggest that psychological variables are also important to understanding wildland fire policy support (Absher, Vaske, Bright, & Kneeshaw in press; Brenkert, Champ, & Flores 2005; Vogt et al. 2005; Winter 2003). The public often under- or over-estimates wildfire risks (Beebe & Omi 1993) and large attitudinal differences sometimes exist between experts and non-experts in risk situations (Zaksek & Arvai 2004). Other research suggests that public expectations and understandings of wildland fire management in the WUI change over time and needs to be affected by well-crafted public education programs (Cortner, Gardner, & Taylor 1990). More recently, however, McCaffrey (2004) concluded that such educational campaigns do not seem to be working, perhaps because of a lack of understanding or trust.

2.0 Methods

Data for this study were obtained from a mail survey of Colorado residents living in the wildland urban interface (WUI). The study population consisted of individuals over the age of 18 who reside in Boulder, Larimer, Gilpen, Grand, Jackson, and Clear Creek counties. A random sample of resident names and addresses were purchased from a commercial sampling firm in the summer of 2004.

2.1 Mail Survey Administration

Four mailings were used to administer the survey beginning at the end of May 2004. Residents first received the 12-page questionnaire, a pre-paid postage return envelope and a personalized cover letter explaining the study and requesting their participation. Ten days after the initial mailing a reminder postcard was sent to participants. A second complete mailing (questionnaire, pre-paid postage return envelope and cover letter) was sent to non-respondents 10 days after the postcard reminder. To further increase response rate, a third complete mailing was sent one month following the second complete mailing. A total of 532 completed surveys were returned with an overall response rate of 47 percent (532 returned / 1,200 sent – 56 non-deliverables).

As a check on potential non-response bias, a telephone survey was conducted of non-response residence (n = 100). Perceived effectiveness, approval and aesthetic impacts of prescribed burning and mechanical thinning variables were included in the telephone survey. For all the variables the Hedge's effect sizes were < .2, indicating a "minimal" relationship (Vaske, Gliner, & Morgan 2002). Non-response bias was thus not considered to be a problem and the data were not weighted.

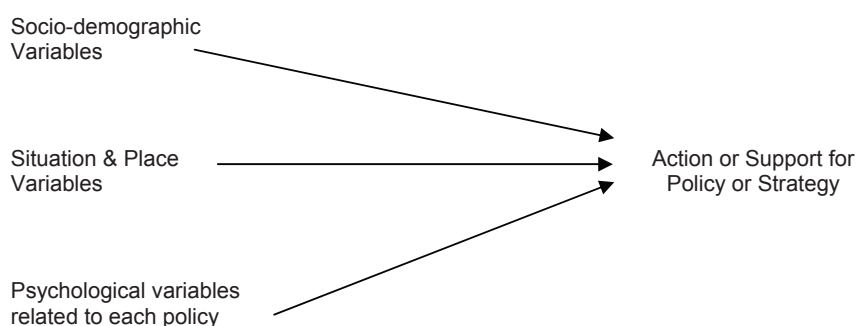


Figure 1.—Basic model of support for policy or action

2.2 Variables in Model

The survey contained four separate independent variables designed to present four common but different wildland fire mitigation strategies. Each was introduced with a short description and reinforced with captioned illustrations. Two strategies dealt with activities homeowners could adopt (i.e., defensible space, firewise construction) and two concerned agency activities (i.e., mechanical thinning, prescribed burns). For analysis purposes, each of these predictors was reduced to a two-level (0, 1) variable. For the homeowner activities, respondents indicated whether or not they currently practice defensible space or have adopted firewise construction. For the agency action strategies an additive composite scale of support was calculated from three (prescribed burns) or four (mechanical thinning) 7-point, Likert-scaled items that gauged the respondent's agreement with the appropriateness and use of the technique (Cronbach's alphas were .83 and .87, respectively). This composite scale was then used to split the respondents into two groups at the "neutral" category, resulting a (0, 1) variable of support for each agency action.

Three sets of independent variables were analyzed. Each group of predictors represented a distinct influence on a policy's implementation or support (Fig. 1). These were comprised of the following original variables in the dataset:

1. Socioeconomic predictors: Age in years, gender, total annual household income in eight categories, and highest level of education in six categories
2. Situational or place-based predictors: Do you live at this address year round? How far from a

forested area is this property? Do you own or rent this property? and How long have you lived in Colorado?

3. Attitudinal measures related to the particular policy/action: How familiar are you with [policy/action]? How effective is [policy/action] at protecting forest /home? Does [policy/action] make your home/property look better or worse? And for defensible space and firewise construction only, How safe would [policy/action] make your property?

Logistic regression was used to estimate the effects of each of the three sets of independent variables on each of the four dependent variables. Twelve separate analyses were run to ascertain the impact of each group of predictors.

3.0 Results:

Over three quarters (79%) of the WUI residents practiced defensible space activities and nearly half (47%) engaged in some form of firewise construction activity (Table 1). Overall, more than four-fifths of the respondents approved of both mechanical thinning and prescribed burn activities (90% and 82%, respectively, above the neutral point in the scale).

Logistic regression with socioeconomic variables accounted for between 2 and 6 percent of the variation in the dependent measures (Table 2). The Nagelkerke R^2 was statistically significant only for the agency actions. The situational variables had a similar impact, explaining approximately 1 to 7 percent of the variation. The situational variables, however, were significant predictors of both personal and agency actions. The psychological

Table 1.—Dependent variables: results of grouping actions.

Dependent Variables	Mean	S.D.	Groups in analysis
Defensible Space	.791	.410	0= No Defensible Space actions 1= Yes, Defensible Space actions
Firewise Construction	.471	.499	0= No Firewise Construction actions 1= Yes, Firewise Construction actions
Mechanical Thinning	.902	.388	0= At or below “neutral” 1= Approve/agree
Prescribed Burning	.822	.297	0= At or below “neutral” 1= Approve/agree

1. Response scale is 0=have done or currently practice, or 1= have not done or never practiced.

2. Response scale is originally from 1= Not at all/Strongly disapprove, to 7= Extremely/Strongly approve, collapsed at 4=Neutral to 0, 1 variable.

Table 2.—Logistic regression results for variable groups as predictors of wildland fire policy: Nagelkerke R² and significance.

Independent Variables	Personal actions		Agency actions	
	Defensible Space	Firewise Construction	Mechanical Thinning	Prescribed Burning
Socio-economic	.021 (ns)	.017 (ns)	.063 (.042)	.054 (.004)
Situational	.073 ($< .001$)	.032 (.021)	.007 (ns)	.020 (ns)
Psychological	.441 ($< .001$)	.270 ($< .001$)	.390 ($< .001$)	.393 ($< .001$)

measures explained 27 to 44 percent of the variance and influenced each of the four policy/mitigation strategies.

The logistic regressions revealed that socioeconomic predictors were statistically significant only for the agency actions ($p = .042$ and $.004$), whereas the situational variables significantly predicted only the personal action variables ($p < .001$ and $p = .002$). The psychological variables were consistently and strongly related to each of the four mitigation strategies ($p < .001$ for each).

4.0. Discussion

WUI residents have adopted some homeowner wildfire mitigation strategies and, on average, support agency-

initiated efforts. Mechanical thinning and prescribed burns were strongly tied to the psychological measures of support, and weakly tied to socio-demographic indicators. Support for these policies can be influenced by tailored communication strategies that focus on the individual level and are crafted for separate market segments.

Firewise construction and defensible space strategies were best predicted by psychological and situational variables, suggesting that agencies should attend to familiarity with a policy or proximity of the residence to the forest. Given the homeowners' costs associated with adopting firewise construction, and the barriers that these might pose for

compliance, residential land developers and the home construction industry should be a primary targets for communication efforts.

The psychological variables displayed strong and consistent links to each policy. The overall pattern suggests that individualized approaches are important to garnering support or behavioral compliance with a wildland fire policy.

The three-factor causal model of policy support provided theoretical and practical results. Although encouraging, more work is needed to further develop a comprehensive model of policy support for wildland fire actions. We suggest further work that analyzes these causes at a more specific level, and that demonstrates the model's use in other geographic and resource settings where wildland fire is an important issue. Our general model should be broadly applicable to other policy arenas, especially those focused on natural resource management or natural disaster issues, we encourage continued testing.

5.0 Citations

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