

Understanding Wildland Fire Basic Beliefs and Social Norms as Antecedents to Fire Management Education and Communications

J.D. Absher¹, A.D. Bright², J.J. Vaske², K. Kneeshaw²

¹ USDA Forest Service, Pacific Southwest Research Station, Riverside, CA [USA](#)

² Colorado State University, Ft. Collins, CO [USA](#)

Abstract

Wildland fires pose an increasing threat to properties and lives in the wildland-urban interface zone. Understanding what stakeholders think about wildland fire, and linking these cognitive patterns (e.g., value orientations, social norms) to management actions, is an important first step in developing a scientific means to inform wildland fire educational and communications programs. Because public values and norms about acceptable wildland fire management often drive agency policies and landowner or recreationist behaviors (e.g., defensible space, campfires), human dimensions concepts must be accurately measured and modelled. This paper presents a measurement model for understanding and predicting public acceptance of wildland fire management. During fall 2001 a mailback survey was sent to a random sample of 2530 people who had been initially contacted at three geographically and ecologically diverse urban-proximate National Forests in the western USA. A total of 1,288 mail surveys were returned for a response rate of 51 percent. Using the cognitive hierarchy as an underlying theoretical framework, fire-specific measures of visitors' basic beliefs and acceptability norms were developed and pre-tested. Measures included scales about six core wildland fire basic beliefs: 1) biocentrism, 2) anthropocentrism, 3) perceived responsibility for protecting homes against wildland fire, 4) homeowners' freedom to build in or near the wildland-urban interface, 5) capability and trust in agency use of prescribed fire, and 6) benefit-harm of wildland fire. Respondents rated the acceptability of each of three possible actions: 1) immediately put the fire out, 2) let the fire burn but contain it so it does not get out of control, and 3) let the fire burn out on its own without trying to contain it. Each action was evaluated relative to contextual variables presented as eight scenarios. The scenarios manipulated five situational factors related to wildland fires: 1) source of fire ignition (lightning vs. unintentionally caused by humans), 2) impact on air quality in nearby communities (not affected vs. poor air quality), 3) threat to private residences located near or inside the boundaries of the forest (low vs. high risk of property damage), 4) forest recovery (few vs. many years), and 5) impact on outdoor recreation within the forest (remain open vs. closed for the rest of the season). Analysis of the basic belief scales and the social norms data demonstrated the reliability and construct validity of the measurement model. The predicted relationships among these concepts provided useful insight regarding public support for different fire management activities. Results are discussed relative to the geographic variation in responses, similarity of beliefs and norms, and the implications for wildland fire education and communication programs.

Introduction and Purpose

The management of wildland fires has been affected by changes in fire management policies (Nelson 1979), increases in the number of residences in or near forested areas (Davis 1990, Perrett 1998), and the public's desire to have a voice in agency decisions (Manfredo and others 1990, Shelby and Speaker 1990). Public acceptance of natural resource policies is often driven by what people believe is appropriate for a given context (Shelby and others

1996, Bright and others 2000, Vaske and others 2001). Context specific normative beliefs influence evaluative judgments about fire management (Kneeshaw and others 2002). Perceptions of, and support for, fire management policies and actions are ultimately rooted in individuals' fundamental values. Understanding how values relate to perceptions of fire management issues (e.g., prescribed fire, fuel treatments, fire suppression, and post-fire forest health issues) constitutes an essential first step for the development of effective education and communication strategies.

Fundamental values are defined as enduring beliefs that are used to evaluate the desirability of specific modes of conduct or the ends achieved through such conduct (Rokeach 1973). According to this view, values are slow to change and do not have a specific referent. In contrast to other concepts (e.g., attitudes, norms) people hold relatively few fundamental values (dozens). Values inform basic beliefs about a cognitive referent (e.g., wildland fires), which leads to numerous situation-specific attitudes, norms and behavior choices. This cognitive hierarchy provides a theoretical framework for connecting the public's fundamental values with more specific beliefs about forest and wildland fire management.

Norms are defined as evaluative standards (acceptability measures) regarding behavior in a given context (for reviews see Donnelly and others 2000, Shelby and Vaske, 1991, Shelby and others 1996, Vaske and Donnelly 2002, Vaske and Whittaker 2003). Relative to wildland fires, norm theory offers a paradigm for understanding why the public judges management actions acceptable or unacceptable in a given context (Kneeshaw and others 2003).

Different contexts typically produce different evaluative standards for what is appropriate or acceptable (Wittmann and others 1998, Zinn and others 1998, Taylor and others 1988). Normative acceptance of fire is influenced by the source of the fire (human versus lightning), the number of acres burned, the impact on wildlife and beliefs that fire can have beneficial or detrimental effects (Taylor and Mutch 1986). Context specific questions better reflect public sentiment than broad questions about the overall acceptability of a management action.

Public acceptance of fire as a management tool has proven problematic in forested areas near urban populations. This wildland-urban interface has witnessed a dramatic increase in the number of residences (Perrett 1998) and participation in recreation activities (Taylor and others 1986). The cognitive hierarchy offers a paradigm for examining when and why specific actions related to fire management are deemed acceptable in the wildland-urban interface (Kneeshaw and others 2002, Bright and others 2003, Absher and others 2003).

This paper focuses on three western, urban-interface national forests and considers three related measurement components of the cognitive hierarchy. The first describes scales used to measure six wildland fire basic beliefs. The second measures support for management actions. Respondents rated the acceptability of three different wildland fire management actions after being given specific scenarios with various combinations of relevant situational information. Third, linkages among the belief and support measures are presented and the implications for wildland fire communications are discussed.

Methods

Sampling and Data Collection

The target population was visitors to the San Bernardino National Forest (near Los Angeles, California), the Mt. Baker–Snoqualmie National Forest (near Seattle, Washington) and the Arapaho–Roosevelt National Forest (near Denver, Colorado). Visitors to each of the three forests ($n = 2,530$) were contacted on-site and asked if they would be willing to complete a mailed questionnaire about perceptions of wildland fire and its management. An initial questionnaire was mailed, followed by a reminder postcard and a second and third mailing of the questionnaire, as needed. In total, 1,288 mail surveys were returned for a response rate of 51 percent. Non-response bias was checked and found not to be a problem.

Basic Beliefs

Six wildland fire basic belief dimensions were measured. Although not exhaustive, the dimensions represented key value-based beliefs reported to drive perceptions of wildland fire management. Two of these dimensions (biocentric and anthropocentric) replicated the work of Vaske and associates (e.g., Vaske and others 2001). Individuals who hold a biocentric view put the health and welfare of ecosystems ahead of human concerns in natural resource management. Anthropocentric people consider humans as primary concern in natural resource management.

Three of the remaining dimensions can be traced to the work of Rokeach (1973) in describing fundamental values. For example, a “responsibility” dimension addressed who is responsible for protecting homes built in or near the urban–wildland interface, and who is responsible for managing the risk of wildland fire (e.g., private landowners, public agencies, both). The “capable/trust” dimension reflected the extent to which the public “trusts” public agencies to effectively manage wildland fire. The “freedom” basic belief dimension examined the extent that private landowners should be free to, or constrained from, building private residences in or near the urban–wildland interface where a wildland fire may occur. Finally, a “benefit/harm dimension addressed wildland fire as a natural process and measured a general belief about whether wildland fire is beneficial or harmful to nature.

The first five basic belief dimensions were comprised of Likert type items that used a 7-point rating scale ranging from “strongly disagree” (1) through a “no opinion” point (4) to “strongly agree” (7). The sixth belief, benefit–harm, was comprised of three questionnaire items: whether wildland fires in national forests, parks, and other natural areas are bad/good, harmful/beneficial, and negative/positive. These three items employed a 7-point semantic differential scale ranging from “extremely bad, harmful, and negative” (1) to “extremely good, beneficial, and positive” (7).

Acceptability Norms

In contrast to the basic beliefs that often apply across a variety situations, norms reflect what people believe is acceptable within a given context (Vaske and others 2001, Zinn and others 1998). Based on previous research (Kneeshaw and others 2002, Taylor and others 1988, Taylor and Mutch 1986), participants’ acceptability norms were constructed from their responses to eight context specific scenarios. The scenarios manipulated five situational

factors related to wildland fires: (1) source of fire ignition (lightning vs. unintentionally caused by humans), (2) impact on air quality in nearby communities (not affected vs. poor air quality), (3) risk of private property damage (low vs. high), (4) forest recovery (few vs. many years), and (5) impact on outdoor recreation within the forest (remain open vs. closed for the rest of the season). Following each scenario, three possible actions the U.S. Forest Service might take were presented: (1) immediately put the fire out (full suppression), (2) let the fire burn but contain it so it does not get out of control, and (3) let the fire burn out on its own without trying to contain it. Respondents rated each of the 24 management actions (8 scenarios x 3 management actions) on 7-point scales ranging from “highly unacceptable” (-3) through “no opinion” (0) to “highly acceptable” (3).

Results and Discussion

Basic Belief Measurement

Reliability (Cronbach's alphas) and confirmatory factor analyses (CFA) examined the internal consistency of each of the six basic belief dimensions. Alphas ranged from .70 to .91 (table 1) and the CFA (see Bright and others 2003 for details) indicated that the basic belief dimensions provided a good fit to the data. These findings supported the construction of simple additive scales for each of the six dimensions.

Table 1— Basic belief scales for three western, urban-interface national forests.

Belief	Mean	Std. dev.	Items	n	Alpha
Biocentric	6.17	1.21	4	1,268	.87
Anthropocentric	2.15	1.09	5	1,260	.78
Responsibility	3.59	1.12	6	1,261	.70
Freedom	4.02	1.52	3	1,270	.76
Capable/trust	5.12	1.23	3	1,270	.79
Benefit-harm	4.31	1.62	3	1,190	.91

Norms and Acceptability Measurement

Wildland fire management actions were rated in a specified context. To reduce respondent burden, a subset of all possible scenarios (contexts) was selected using SPSS Conjoint 10.0 (SPSS 1999). The resulting eight scenarios are shown in table 2. Following each scenario, respondents rated the acceptability of each of the three management actions (put fire out, contain fire and let fire burn).

Table 2 Fire management scenarios by situational factors

Scenario	Origin of fire	Air quality	Private property	Forest recovery	Outdoor recreation
1	Lightning	No Effect	High Risk	Many Years	Closed
2	Humans	Poor Air	Low Risk	Many Years	Closed
3	Lightning	No Effect	Low Risk	Quick	Closed
4	Humans	No Effect	High Risk	Many Years	Remain Open
5	Lightning	Poor Air	High Risk	Quick	Remain Open
6	Humans	Poor Air	High Risk	Quick	Closed
7	Humans	No Effect	Low Risk	Quick	Remain Open
8	Lightning	Poor Air	Low Risk	Many Years	Remain Open

Table 3 displays the mean acceptability ratings for each management action by scenario; Figure 1 displays the same findings graphically. Positive means represent “acceptable” management actions and negative means represent “unacceptable” management actions. The higher the mean score, the more “acceptable” the action is, and the lower the mean score, the less “acceptable” the action. Paired t-tests were used to evaluate significant differences in mean acceptability ratings. After adjusting for multiple comparisons (Bonferroni Correction = .05/24), the alpha level was set at .002. Results show statistically significant differences in acceptability ratings of the management actions within each of the eight scenarios.

Table 3. Mean differences in acceptability ratings of fire management actions for eight fire scenarios

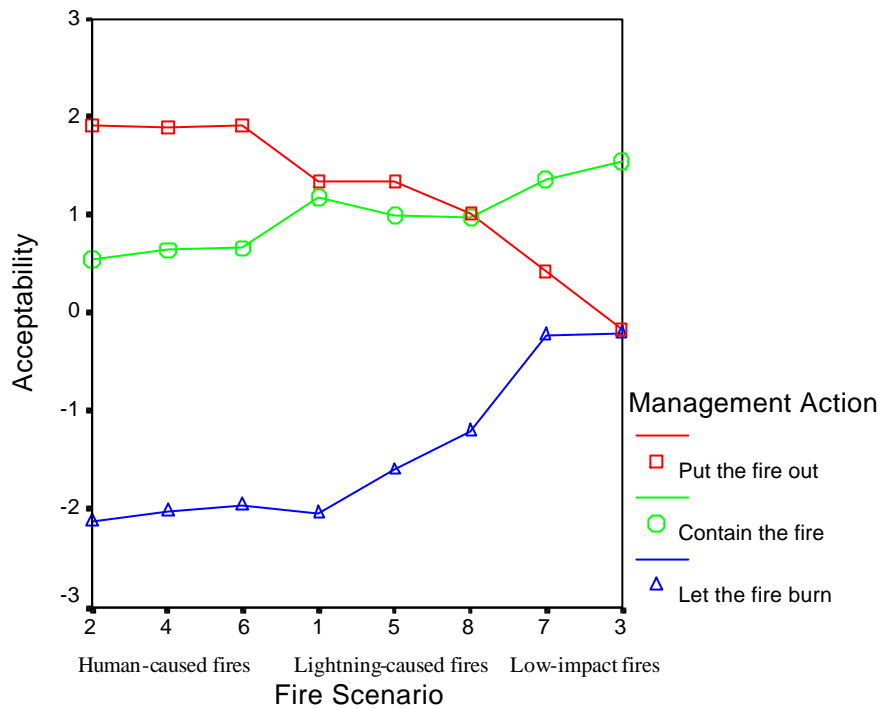
Scenario	Management Action ^{1, 2}			<i>F</i> -value ³
	Put Fire Out	Contain Fire	Let Fire Burn	
1	1.33 ^a	1.18 ^a	-2.06 ^b	2,087.41
2	1.90 ^a	.54 ^b	-2.12 ^c	2,419.10
3	-.17 ^a	1.54 ^b	-.23 ^a	416.66
4	1.88 ^a	.64 ^b	-2.03 ^c	1,985.66
5	1.32 ^a	.98 ^b	-1.62 ^c	1,067.07
6	1.92 ^a	.65 ^b	-1.97 ^c	1,996.06
7	.41 ^a	1.35 ^b	-.25 ^c	272.87
8	1.01 ^a	.96 ^a	-1.21 ^b	623.26

¹. Means represent data from all three forests combined, n= 1,288. Scale ranges from -3 (Highly unacceptable) to +3 (Highly acceptable).

². Means with different superscripts are significant at $p < .002$ based on Bonferroni Correction for multiple paired t-test comparisons.

³. *F*-values based on Wilks’ Lambda multivariate test statistic. With Bonferroni Correction, all values are significant at $p < .006$.

Mean acceptability ratings and normative agreement for fire management actions varied according to the fire scenario evaluated. Across all scenarios, acceptability ratings were highest for “put the fire out” or “contain the fire,” depending on the conditions described in the scenario. Acceptance of “put the fire out,” for example, was highest for human-caused fires (scenarios 2, 4, and 6), lower for lightning-caused fires (scenarios 1, 5, and 8) and lowest for low-impact fires (scenarios 3 and 7). In contrast, the acceptability ratings for “contain the fire” were lowest for human-caused fires, higher for lightning-caused fires and highest for low-impact fires. In the “low-impact fires” (scenarios 3 and 7), the “let the fire burn” management action was more acceptable than for any of the other scenarios.



Wilks' Lambda $F(14, 1197) = 157.74, p < .001, \text{partial } \eta\text{-squared} = .65.$

Figure 1. Fire Norms: Acceptability by Management Scenarios (Grouped by type)

Predicting Support for Management Actions

Basic beliefs are at the foundational stage of a long causal sequence that flows from values to behaviors. Consistent with previous work on the cognitive hierarchy, linkages from basic beliefs to support for wildland fire management actions are important to establish (Vaske and others 2001). In general, basic beliefs are predicted to influence a person's support for management actions both directly and indirectly. As an initial step, we examined the direct relationship between support for a management action or policy and the underlying basic beliefs (table 4).

Scenario ratings were aggregated for each management option, resulting in three scores for each respondent representing: Put the fire out, contain the fire and let the fire burn. Separate regressions were estimated using the averaged norm acceptability ratings as the dependent variable and the six basic beliefs as independent variables. The beliefs accounted for a significant part of the variation in management options for each type of action (adjusted $R^2 = .301, .163, \text{ and } .164$ respectively). Benefit-harm seems to be a universal basic belief that underlies support for management action; the concept was significant in each of the three equations. Other basic beliefs, however, influenced the norms in different ways. People who valued freedom and responsibility expected stronger fire suppression actions (i.e., put the fire out). Containing the fire was tied to perceptions about the agency's capability in managing prescribed fires. Let the fire burn was also predicted by biocentrism and responsibility.

Table 4. Regression of individual support for wildland fire management actions against six basic belief measures.

Management action	Adj. R ²	Model F-value ¹	Beliefs with significant coefficients ²
Put the fire out	.301	87.49	Responsibility, Freedom, Benefit-harm
Contain the fire	.163	67.05	Capable/trust, Benefit-harm
Let the fire burn	.154	37.23	Biocentric, Responsibility, Benefit-harm

¹. F-test has 6 and 1189, 1192 and 1197 d.f., respectively. Each model (regression) is significant at <.001.

². Coefficients (betas) for individual beliefs listed are significant at p< .001

Conclusions

Communicating about wildland fire management options or policies will greatly benefit from a better understanding of the cognitive hierarchy that informs support for management actions. This study presented measures of six basic beliefs about wildland fire, normative ratings of three fire management actions in a scenario-based approach, and a brief look at the linkages between beliefs and ratings. The results suggest that some values operate more strongly, and at times perhaps universally, for wildland fire issues. More work needs to be done on the basic belief scales to improve scales for field use, and to extend the range of values measured. The normative measures provided a structured way to assess management options with reference to factors that influence acceptance. Further, the linkages between beliefs and management preferences suggest that wildland fire communications can, and should, be tailored to the context and the proposed policy or action. Specific beliefs are clearly linked to specific management actions or policies. Further refinement of an overall wildland fire communications model is needed, as are better linkages to other measurements in the causal chain that leads to support for wildland fire actions and responsible behaviors. Especially suggested is a full test of the impact and importance of basic beliefs in wildland fire management, especially with other known measures of attitudes or behavioral intent, socio-demographics or other measures, to elucidate more fully the cognitive hierarchy for wildland fire. Many arenas of application are possible from resident and non-resident communication strategies, forest health issues, fuels management treatments, post-fire rehabilitation efforts and many others. Further extension of the scenario (setting) based acceptability ratings work is also warranted, as is trying this approach in other geographic areas, with other management actions and/or situational variables.

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