

Visitor Compliance With Fire Restrictions: An Observational Study Using Verbal Messages and Symbolic Signage

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Abstract

The purpose of this study was to examine the effects of message type and source on visitor compliance with fire restrictions at the Applewhite Picnic Area, Cajon Ranger District, San Bernardino National Forest, California. Six treatments were administered during summer 2005 involving verbal messages (awareness of consequences and altruistic messages) and signage for primarily Hispanic recreation visitors. Six treatment groups were assigned: sign only, sign/verbal moral, sign/verbal fear, no sign/verbal moral, no sign/verbal fear, and no sign/no verbal (control). During treatments using signage, two signs containing “no fire” symbols were posted in each experimental zone. Visitor behavior was recorded by independent observers using a Behavior Anchored Rating Scale and grouped into three general compliance categories: superior compliance, marginal compliance, and poor compliance ($n = 263$). The results, using a 2×3 ANOVA, indicated (a) a significant interaction effect between signage and messages, (b) a significant difference between message types with a fear appeal having significantly higher compliance scores than a moral appeal, and (c) no significant difference between a sign and no sign. The results may assist land and recreation managers in developing effective informational programs related to fire safety and regulations that successfully influence visitor behavior.

Keywords: Persuasive communication, fire management, wildland-urban interface.

Introduction

Fire management strategies have changed dramatically over the past 40 years, ranging from all-out suppression at the turn of the century to the use of prescribed burns and fire management techniques in the 1970s (Taylor et al. 1986). The severity of the 2000 season highlighted the lack of a comprehensive understanding of

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fire regimes, and demonstrated the limiting affects of continued fire suppression on investigations into environmental and social interactions with fire management. In response, the federal government developed the National Fire Plan. This investigation into fire management strategy was focused on protecting the needs of both communities and the natural environment (National Fire Plan 2001). Pursuant to the National Fire Plan, the National Wildfire Coordinating Group released a report in 2001 illustrating the role social sciences could play in fire management strategies. Specifically, social science methodologies could investigate public values, attitudes and behaviors, and the efficacy of public communication efforts in relation to fire and fire management (Hoover and Langer 2003).

Outdoor recreation has been, and will continue to be, popular across most segments of the population in the United States (Cordell et al. 1996, Douglas 1999). However, the social landscape of outdoor recreation in America is constantly changing. Observed shifts have been due in part to increased participation, changes in participant ethnicity/race, and increased open space accessibility. As natural resource recreation visitors become more diverse and active, researchers must provide managers with studies describing the specific recreational values of each user group to direct effective management strategies (Cordell et al. 2002, Viriden and Walker 1999). Social science methodologies can serve as a guide to assist managers in meeting the needs of the recreation participants and to understand and mitigate for the impacts associated with increased use including crowding, vandalism, and increased fire danger (Manning 1999, Roggenbuck and Berrier 1982).

Persuasive communication is a theoretical social psychology framework developed to understand effective methods of changing attitudes or behaviors (Manfredo 1992). Petty and Cacioppo (1981) and Ajzen (1992) suggested a breakdown of the key factors that affect the reception of a message. These factors include message source, target receiver group, message channel, message type, and situational variability. The influential qualities of these factors have been investigated, and results indicate each factor must be manipulated for a particular setting and management concern. For example, various persuasive communication channels have been used to influence visitor behavior in outdoor recreation settings. These channels may include signage (Al-Madani and Al-Janahi 2000, Chavez et al. 2003, Davies et al. 1998, Dwyer et al. 1989), fear-based and morality-based verbal appeals (Christensen 1981, Hendricks et al. 2001, Johnson Tew and Havitz 2002, Oliver et al. 1985, Roggenbuck and Berrier 1982, Vander Stoep and Gramann 1987), bulletin boards (McCool and Cole 2000), brochures (Lime and Lucas 1977, Martin 1992, Oliver et al. 1985, Roggenbuck and Berrier 1982), or informational slide shows (Morgan and Gramman 1989). Often, in order to find the most influential message

for a particular area or user group, researchers have studied these techniques in conjunction (Oliver et al. 1985, Roggenbuck and Berrier 1982). Verbal appeals and written appeals, whether through signage, brochures, or bulletin boards, have been generally shown to decrease depreciative behaviors in outdoor recreation settings (Burgess et al. 1971, Christensen 1981, Cole 1998, Manning 2003, Martin 1992, Oliver et al. 1985, Samdahl and Christensen 1985). However, little research has been devoted to the persuasive message factors that may influence, and in turn opportunities to manage for, fire-related depreciative behaviors. In addition, analyses of the persuasive properties of symbolic signage have yet to be conducted for wildfire management, although such analyses are commonly used in the field of recreation and land management (Chavez et al. 2003).

The purpose of this study was to understand the types of persuasive messages that most effectively influence visitor compliance with fire restrictions in a southern California national forest. This study investigated three questions regarding the use of fear- and moral-based verbal appeals, and symbolic signage on the primarily Hispanic visitors to a day-use area at the wildland-urban interface:

1. Is there a difference between moral and fear verbal appeals in gaining visitor compliance with fire restrictions?
2. Does a “no fire” symbolic sign influence visitor compliance?
3. Do messages and signage interact to explain compliance with fire restrictions?

The results and implications of this study may provide land managers within the southern California area data regarding fire-associated visitor behavior, particularly for Hispanic visitors. In addition, this study may provide useful data for managers overseeing areas with similar environmental and demographic characteristics. The goal in both cases is to aid in the construction of management campaigns to reduce fire hazards associated with human use of outdoor areas.

Methods

The study took place at the Applewhite Picnic Area (AWPA) at Lytle Creek in the Cajon Ranger District of the San Bernardino National Forest (SBNF), 15 miles west of the city of San Bernardino. The picnicking areas are on either side of a half-mile-long, meandering parking lot that spans the entire site. Lytle Creek is located on the south side of the parking lot with approximately half of the picnicking sites following the creek. Past investigations into the typical user group for AWPA have shown that visitors are primarily Hispanic groups of up to 15 people. These groups usually arrive in the morning, reserve a picnicking area, and stay until late in the afternoon (Chavez 2002).

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A Behavior Anchor Rating Scale (BARS) was developed to measure the level of compliance as the dependent or response variable (1 to 3: noncompliance, 4 to 6: marginal compliance, 7 to 9: superior compliance) (Cronbach 1990). This type of BARS allowed research assistants to note individuals' behavior at the time of occurrence and to determine the rating that best described the action (Cronbach 1990, Hendricks et al. 2001). Prior to data collection, the rating scale was reviewed and revised, based on comments by San Bernardino National Forest land managers and policymakers, to ensure the example actions were realistic and accurate.

Six treatment groups were assigned: sign only, sign/verbal moral, sign/verbal fear, no sign/verbal moral, no sign/verbal fear, and no sign/no verbal. During treatments using signage, two signs containing "no fire" symbols were posted in each experimental zone. Six weekend days were randomly selected for data collection between June 25th and July 25th of 2005. The picnic area was divided into zones at either end of the half-mile parking lot. Because each zone was at the far end of the picnic area, the layout allowed for two treatments to be administered during the same time block. However, based on low visitor usage on some weekend days, some treatments were administered one time only. In addition, research assistants conducted visitor counts at the beginning and end of each treatment day.

Verbal messages were administered by two female Spanish-speaking research assistants and the messages were directed to the oldest male member of the group because of predefined cultural-based gender roles (Alvarez and Bean 1976, Chavez 2003, Hutchison 1987). Assistants were dressed in plain clothes, but identified themselves as U.S. Department of Agriculture Forest Service (USFS) volunteers. The verbal moral appeal focused on the effect of defined restricted actions on the surrounding environmental and social communities. The verbal fear appeal focused on the effect of certain behaviors on the individual who performs those actions such as alerting the individual that certain behaviors may result in fines or punishment. Signs were posted on existing speed-limit and "no parking" signs, as these signs were highly visible to visitors. The sign showed a flame with a red slash over the symbol (fig. 1). This symbol was designed to communicate that fire and open flames were restricted. The symbolic signage design followed the sign guidelines in *Sign and Poster Guidelines for the Forest Service* (USDA FS 1998).

During the treatments, observers rated behaviors on a 1 to 9 scale describing three types of compliance: noncompliance, marginal compliance, and superior compliance. The ratings were then treated as interval data and analyzed using an analysis of variance (ANOVA). Following an ANOVA, treatment comparisons were conducted using a Dunnett T3 analysis.



Figure 1—U.S. Department of Agriculture, Forest Service symbol used to make “no fire” symbolic signs for the experimental treatments.

Results

Two hundred and sixty-three observations were recorded between June 25 and July 18, 2005. Approximately 1,500 people visited the area on the weekends during the 6-week period, and most users picnicked on Sundays. On days when both treatment zones were open, more than 400 people entered the AWPA. The average group size was 11, and the largest recorded group consisted of 30 people. A majority of users, approximately 85 percent, were Hispanic. Families usually barbequed all day, played and lounged by the creek, and included multigenerational groups. In many cases, more than half of the group were children. Groups tended to socialize with neighboring families, and most visitors spent the warmer parts of the day by the creek even if picnicking in other areas of the AWPA. Observers noted visitors often littered, and litter was observed to increase on windy days. The use of fireworks was not noted at any time.

Approximately 53 percent ($n = 139$) of all behavioral observations were rated as “superior compliance.” The most often recorded “marginal compliance” behavior was unattended barbeques ($n = 60$), followed by observations of visitors causing large grill fires ($n = 17$). Fifteen recorded occurrences, approximately 6 percent of all behaviors, included the burning of litter or wood, and was the third most common example of behavioral “noncompliance” (table 7).

The ANOVA results showed verbal messages were significantly different than other treatments in influencing compliance (table 8). According to the analysis of variance and the Tukey analysis (table 9), a verbal fear appeal differed from both the verbal moral treatment and no verbal appeal. Compliance ratings associated with exposure to symbolic signage was not significantly different from the control (no sign/no verbal) (table 8). In addition, the use of signage and verbal appeals in conjunction appear to significantly affect compliance ratings, decreasing or increasing mean compliance ratings when compared to sign only and verbal only treatments (see table 10).

Approximately 53 percent of all behavioral observations were rated as superior compliance. The most often recorded marginal compliance behavior was unattended barbeques, followed by observations of visitors causing large grill fires.

Table 7—Frequencies of reported actions

Reported actions	Reports	
	<i>Number</i>	<i>Percent</i>
Noncompliance:		
Burning natural resources or trash	15	5.7
Use of personal grill on vegetation or creek	11	3.1
Open fire/flame left unattended while barbequing near vegetation or creek	5	1.9
Smoldering ashes of litter dumped near vegetation or creek/water spout	3	1.1
Marginal compliance:		
Barbecue left lit or unattended while barbequing	60	23.8
Large fire with personal or provided grill	17	6.5
Propane barbeque near vegetation or on the ground	11	3.1
Cigarette butts extinguished and tossed near vegetation or creek	1	.4
Ashes extinguished and dumped in picnic area	1	.4
Superior compliance:		
Barbequing with provided grills	62	23.6
No fire or flame left unattended	43	16.4
Safety with propane or personal grill	34	12.9

Table 8—Two-way ANOVA and Dunnet T3 significance testing

Source	DF	Sum of squares	Mean square	F	p value
ANOVA					
Signage	1	0.795	0.795	0.14	0.707
Verbal appeals	2	67.41	33.70	6.00	.003
Signage × verbal appeals	2	49.84	29.92	4.43	.013

Table 9—Tukey’s test for multiple comparisons

Comparison	Difference between means	Significant at $\alpha = 0.05$
Fear appeal v. no verbal	1.151	Yes
Moral appeal v. no verbal	0.328	No
Fear appeal v. moral appeal	0.822	Yes

Table 10—Frequencies and percentages of compliance

Treatment	Poor compliance		Marginal compliance		Superior compliance		Mean compliance rating
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	
Control	7	16	16	38	19	45	6.19
Sign	0	0	4	44	5	55	6.67
Verbal fear	9	9	25	25	67	66	7.13
Verbal fear/sign	1	3	3	9	29	88	8.33
Verbal moral	1	4	7	27	18	69	7.27
Verbal moral/sign	9	17	16	31	27	52	6.29

Conclusions

Overall, the results of this study indicate the use of verbal appeals may be an effective strategy to communicate fire regulations and influence visitor behavior. According to the analysis, the fear appeal used in this study was quite effective. Moreover, our fear appeal used in conjunction with symbolic signage produced the highest mean compliance ratings. Compliance scores associated with the use of symbolic signage did not significantly differ from mean compliance ratings recorded for the control. This may be due in part to the presence in the area of small symbolic signs posted on bulletin boards and the USFS ongoing campaign to reduce fire hazards at the wildland-urban interface. The USFS posted signs are smaller representations of an open flame with a red slash through it, and are posted by the restrooms during the spring and summer months. The signage treatment applied in this study included larger versions of these signs posted in more visible areas.

According to mean compliance ratings, verbal messages were more effective than the signage treatment or control in influencing visitor behavioral compliance with fire restrictions. Verbal moral and verbal fear messages showed meaningful compliance differences, with verbal moral showing higher compliance. Verbal fear appeals caused higher frequencies of superior compliance when used with symbolic signage than did verbal moral appeals with signage.

The results of this study indicate that the use of both types of verbal appeal increases visitor compliance with fire restrictions when compared to the control and signage only scenarios. Verbal fear messages used in this study were shown to be an effective method of influencing visitor compliance especially when used with signage. The verbal moral appeal used in this study was less influential when used in conjunction with signage than the verbal moral appeal alone. Generally speaking, superior compliance activities were frequent prior to the application of experimental treatments, during the control treatment; AWPA visitors seem to be aware of fire restrictions and appropriate behavior. Managers of the San Bernardino National Forest may consider including the application of verbal appeals during periods of high fire danger to further increase compliance. This study indicates that the verbal fear message specifically, in conjunction with the current use of symbolic signage, may increase visitor compliance with fire restrictions during the spring and summer months. To further ensure compliance, USFS managers could continue to intermittently patrol the picnic area to show a law enforcement presence and possibly deter the small number of irresponsible visitors.

The results of this study provide encouraging data regarding visitor behavior within the AWPA and within the southern California region. However, research could be extended to provide further clarification on behavioral compliance with

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fire restrictions and to expand on previous research regarding visitor characteristics and recreation preferences. Recommendations for further research include the replication of this study with other racial/ethnic groups, the use of other fire symbols as signage, and the use of other message sources. Messaging overload should also be investigated in this context to describe the effect of multiple channels of “no fire” messages. In addition, different verbal appeals could be tested using tailored messages that address specific “noncompliance” behaviors such as the burning of natural resources.

Metric equivalents:

1 mile = 1.61 kilometers

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