The Impact of Normative Message Types on Off-Trail Hiking

Patricia L. Winter
Research Social Scientist
United States Department of Agriculture, Forest Service
Pacific Southwest Research Station
4955 Canyon Crest Drive
Riverside, California, 92507
phone (951)680-1557
pwinter@fs.fed.us

Abstract
Depreciative activities and high annual visitation levels threaten the health and sustainability of the giant Sequoia. Signage is one route to managing visitor behavior. Research suggests a two-by-two conceptualization of normative messages in signs. Messages may present the "ought" (injunctive) or the "is" (descriptive) of behavior and may be stated positively (prescriptive) or negatively (proscriptive). This paper summarizes findings from an experiment testing normative messages and presents evidence for injunctive-proscriptive messages as the most effective route in gaining desired behavior. Under this condition off-trail hiking was less likely to occur, compared to the incidence of off-trail hiking under four other conditions (including a control under which no additional sign was posted). In contrast, the incidence of off-trail hiking was greatest when the descriptive-proscriptive message was used (when compared to three other message types). The injunctive-proscriptive message is most appropriate when a behavior is desired shortly after exposure to a message and may not be most effective when longer-term maintenance of actions is desired.

Keywords
normative message framing, depreciative behaviors, off-trail hiking, natural resource management, signage

Acknowledgements
The author recognizes the assistance of Drs. Robert Cialdini (Arizona State University), James Gramman (National Park Service), David Graber (National Park Service), and Haiganoush Preisler (USDA Forest Service) for their reviews of the planned research. Steve Esson provided assis-

tance with sign layout; Annie Esparanza with acquiring the posts (both are with the National Park Service).

The Impact of Normative Message Types on Off-Trail Hiking

Depreciative behavior, such as littering, graffiti, and off-trail use poses a threat to the health and sustainability of the Giant Sequoia and its surrounding habitat. Human impacts are not a new threat. However, designation of the home to many of the Giant Sequoia as Sequoia and Kings Canyon National Parks helped to reduce that threat (Dilsaver & Tweed, 1990). Annual visitation to the two parks exceeds 1.5 million, with peak visitation during summer and fall (Stynes & Sun, 2003). Efforts to mitigate the extensive impacts of being a popular visitation area have been employed. Examples of these efforts include hardening of trails, posting signs, and erecting split rail fencing or other barriers to preclude off-trail hiking near the Sequoias. Visits by ranger patrols and interpretive staff, and educational programs at the visitor centers are further measures. Mitigation efforts vary by site and are reflective of typical use levels as well as the intended visitor experience at each location (Dilsaver & Tweed, 1990). Limitations on visitation (for example through limited parking and other forms of development) have also worked to limit impacts (Dilsaver & Tweed, 1990). Some off-trail use is tolerated by the ecosystem; however, the amount of soil compaction and erosion that is acceptable is weighed against the level of visitation at each site. Agencies need to manage sites in a way that provides for an enjoyable visitor experience and at the same time protects the natural resource (Kuo, 2002).

Indirect methods of visitor management (such as signage, brochures, and bulletin boards) are frequently relied on in natural resource settings (Chavez, 1996; Johnson, Vande Kamp, & Swearingen, 1994; Tynon, Chavez, & Harding, 1997). Recreationists and the general public tend to approve of signs in recreation settings to address a variety of issues (Chavez, 2001; Cvektovich & Winter, 1998; 2002; Wirsching, Leung, & Attarian, 2003) though how effective signs are expected to be in gaining desired behaviors and protecting settings varies (Cvetkovich & Winter, 1998; 2002; Winter & Cvetkovich, 2003). Recent studies of the effectiveness of signage, in light of their frequent usage in natural resource management, are rare (Gramann, 2000).

Signs vary in effectiveness based on placement of the sign, length of the message contained, importance to the visitor, language of the message vs. language of the visitor, and normative message content and presentation. Poorly constructed signs may work against the intent of the managing agency, either by failing to be noticed, or by actually increasing the likelihood of undesirable activities. For example, work by Marin (1994) showed that individuals whose primary language is Spanish might not notice strategically placed signs and messages unless they are in Spanish. Poorly translated signs, such as those discussed by Chavez (2001) may be noticed but due to poor translation may still be ineffective. Other work suggests that signs should meet a particular need or interest of the visitor in order to be noticed (McCool & Cole, 2000; Nickerson, 2003). Interest may be driven in part by message content and style of presentation (Lackey & Ham, 2003; Ward et al., 2003), with questions, activities, or other thought-provoking content deemed to be of greater interest to visitors.

A distinction should be made between interpretation and communication regarding judgment of effective content. Where the purpose of interpretation may be to engage and

provoke, rather than instruct (Kuo, 2002), the interest of this paper is on visitor information and communication directed at gaining behavioral compliance. Recommendations for effectiveness may be quite different for interpretive purposes.

Signs are not always the most effective intervention in cases where depreciative activities are taking place. Effectiveness of signage varies based on the problem being targeted. Manning (2003) distinguished between depreciative activities that are intentionally illegal or that are unavoidable, versus those that are due to carelessness, a lack of skill, or a lack of knowledge. The latter are viewed as more amenable to indirect management approaches than illegal or unavoidable behaviors (Manning, 2003). However, limited resources, vast areas managed, and the value in having a salient reminder of expected conduct, all make signs an important aspect of managing our nation's resources. A recent study suggested that signage, when the message was properly constructed, was equal in effectiveness to a written pledge and a uniformed volunteer in deterring theft of petrified wood (Widner & Roggenbuck, 2000).

Signs can be particularly valuable in evoking desired actions when properly worded with the understanding that some messages are simply more persuasive than others (Kuo, 2002). Research points to a two-by-two conceptualization of messages in signs that might influence visitor behavior (Cialdini, 1996; Cialdini, Reno, & Kallgren, 1990; Cialdini, Kallgren, & Reno, 1991; Reno, Cialdini, & Kallgren, 1993). Signs may have an injunctive focus (tell visitors what they should do), or a descriptive focus (tell visitors what other visitors do). Further they may be framed proscriptively (focus on discouraging negative behavior), or prescriptively (focus on encouraging positive behavior).

In an onsite evaluation of messages in signs at natural resource settings a preponderance of injunctive-proscriptive messages was revealed (Winter et al., 1998). The preponderance of these messages demonstrated the reliance on negatively worded admonitions within messages on signs in natural resource settings. In a follow-up study, a random sample of interpretation professionals compared the effectiveness of "encouraging" and "discouraging" injunctive messages (descriptive messages were not tested since they were quite rare in the onsite evaluations of signs). The respondents rated the encouraging messages as much more effective than the discouraging ones (Winter et al., 2000). In fact, years of experience in interpretation had a significant, positive relationship with tendency to rate the encouraging messages as more effective. Comparing the findings from these two studies, the evaluation of the environmental professionals ran counter to what was found to be the main practice on actual signs.

An onsite experiment was run at the Petrified Forest National Park (Cialdini et al., 2006). An examination of signage was conducted, comparing the four types of normative messages and the impact on theft of petrified wood. The injunctive-proscriptive message (describing that negative behavior is discouraged) was most effective, as park visitors removed the fewest pieces of wood when this type of sign was posted. In contrast, the descriptive-proscriptive condition (describing that negative behavior is often performed) showed the greatest amount of theft of petrified wood. In fact, theft was higher than in the control condition (no additional signage) demonstrating the potential for messages to backfire. It is quite likely that the counter-productive effect had to do with the normative information (via the descriptive-proscriptive message) that was presented. If a message contains the idea that others are stealing petrified wood and that this is occurring frequently in the setting (presenting theft of wood as the norm, see for example Cialdini,

Kallgren, & Reno, 1991; Schultz, 1998), we would expect that others would be more likely to steal the wood as well.

An extension of previous work on normative messages in signs (Cialdini et al., 2006) was implemented at Sequoia and Kings Canyon National Parks in the summer of 2004. This study compared the level of off-trail recreation use under each of five conditions based on the four normative message approaches and one control condition. The control involved no additional sign posted beyond that already present in the park. While the same four message types and the control are a replication of those tested by Cialdini et al. (2006) the current study's signs did not include a graphic (the Cialdini et al. study did). Second, the theft of petrified wood seemed to be a clearer violation of acceptable conduct (stealing of park property) than off-trail hiking might be (for example, Roggenbuck, Widner, and Stratton's 1997 report found that visitors do not approve of theft of petrified wood). Finally, it was expected that off-trail hiking would occur more often than theft of petrified wood, which Cialdini et al. (2006) found to be rare. (Roggenbuck et al. 1997 also reported removal of petrified wood as a rare event. However, in spite of the reported rarity, removal has a significant, permanent impact on the sustainability of the park.) Findings are instructive towards managing off-trail use; and can be extended to other visitor behaviors that might also be influenced through signage. The approach is simple and practical, modeled after the behavioral analysis tradition wherein an overt behavior (as the dependent variable) is targeted and environmental stimuli (the independent variables) are manipulated to gain the desired behavior change (Geller, 1992).

Method

Development of Signs

Signs were developed with each of the four message types and posting methods were selected in consultation with park staff. Each sign complied with the parks' layout guidelines. The sign maker for the two parks provided the layout. Four sign messages were developed and eight signs were made (two of each) as follows:

> Condition I – Injunctive - Proscriptive
> Please don't go off the established paths and trails, in order to protect the Sequoias and natural vegetation in this park.
>
> Condition II – Descriptive - Proscriptive
> Many past visitors have gone off the established paths and trails, changing the natural state of the Sequoias and vegetation in this park.
>
> Condition III – Injunctive - Prescriptive
> Please stay on the established paths and trails, in order to protect the Sequoias and natural vegetation in this park.
>
> Condition IV – Descriptive - Prescriptive
> The vast majority of past visitors have stayed on the established paths and trails, helping to preserve the natural state of the Sequoias and vegetation in this park.

Figure 1. Descriptive-Prescriptive Sign at Big Trees Trail

Condition V - Control
No sign other than those already in use was added to the setting.

The signs were constructed of lightweight aluminum and each was the same size and shape (rectangular, 12" by 16"). A dark brown background with white lettering was used in order to match the majority of information signs used by the National Park Service (fig. 1). The signs had drilled holes in the top and bottom center so that bolts could be run through the sign, allowing attachment to an iron signpost. The signposts were on loan from the park and had been used in a previous study on air quality.

Sites of Observation/Experimentation
The sites where the experiment was conducted included Congress Trail, Big Trees Trail, Crescent Meadow, and Grant Grove. The observations were made from the same point at the selected sites across all experimental sessions. Each of the sites has unique features in terms of trails and presence or absence of barriers. Congress Trail has a paved path for visitors to walk along through the big trees; however there is no barrier along the section of trail chosen for observation. Slightly northeast is the pathway to the General Sherman tree, with wooden railings. The selected point of observation looked down the trail from its entrance towards the "Leaning Tree" and a bridge across a small creek.

	Location							
Condition	Congress Trail		Big Trees Trail		Crescent Meadow		Grant Grove	
Injunctive-Proscriptive	Sat[1]	Sun	Sat	Sun	Sat	Sun	Sat	Sun
	1	81	***5***	85	9	***89***	13	93
	2[2]	82	6	86	10	90	14	94
	3	83	7	87	11	91	15	***95***
	4	84	8	88	12	92	16	96
Descriptive-Proscriptive	Sat	Sun	Sat	Sun	Sat	Sun	Sat	Sun
	17	97	21	101	25	105	29	109
	18	98	22	102	26	106	30	110
	19	99	23	103	27	107	***31***	111
	20	***100***	24	***104***	28	***108***	32	112
Injunctive-Prescriptive	Sat	Sun	Sat	Sun	Sat	Sun	Sat	Sun
	33	113	37	117	41	***121***	45	125
	34	114	38	118	42	122	46	***126***
	35	115	***39***	119	43	123	47	127
	36	116	40	120	44	124	48	128
Descriptive-Prescriptive	Sat	Sun	Sat	Sun	Sat	Sun	Sat	Sun
	49	129	53	***133***	57	137	***61***	141
	50	130	54	134	58	138	62	142
	51	131	55	135	***59***	139	63	143
	52	132	56	136	60	140	64	144
Control	Sat	Sun	Sat	Sun	Sat	Sun	Sat	Sun
	65	145	69	149	73	153	77	***157***
	66	146	***70***	150	74	154	78	158
	67	***147***	71	151	75	155	79	159
	68	148	72	152	***76***	156	80	160

[1] The four numbers in this cell and column correspond to the four timeblocks (e.g., 8:30 to 10:30am).
[2] Entries selected for the sample are in bold and italics.

Table 1. Grid Used for Random Selection of Day of Week, Time of Day, Location, and Condition

Big Trees Trail has no railings along the main trail, other than those placed around the front entrance that frame the meadow. The trail is paved in most sections, although some sections are wooden boardwalk. The point of observation that was selected included the front-most portion of the trail around the main meadow, with two Sequoias in full view. Crescent Meadow is free of railings and the path to the northeast from the southern end at the parking area is paved. The trail to the left, heading northwest from the parking area, through the picnic area is unpaved and winds around the section of the meadow furthest from the parking lot. The selected point of observation was to the northeast edge of the meadow, on the trail towards Tharp's Log, focused on the viewpoint overlooking the meadow and adjacent to signage reminding visitors to stay on the

trail. This site was unique from the others in that trespass off the trail at the point of observation would lead a recreationist into the meadow rather than around the big trees. Grant Grove trail is paved and framed in wooden railings for the majority of the trail. The observation point selected was the main viewpoint directly in front of the General Grant tree.

Random Process for Construction of Experimental Sessions

Sessions were scheduled using a random assignment process. A grid was designed to facilitate random assignment (Table 1). Five rows were set in the grid, matching the five experimental conditions. The grid had four columns, matching the four locations where observations were to occur (Congress Trail, Big Trees Trail, Crescent Meadow, Grant Grove). Twenty cells resulted from this method (five conditions by four locations). In each of these cells eight numbers were entered. These numbers represented time blocks for observations on Saturday and Sunday. Two morning time periods (8:30 to 10:30 and 10:30 to 12:30) and two afternoon time periods (13:30 to 15:30 and 15:00 to 17:00) were represented in each of these cells. The eight numbers in each cell were in sequence. First all Saturday numbers were entered, working by row and then column, such that the first row, first cell, had numbers 1 through 4, and then the first row and second column had numbers 5 through 8, and so on through number 80 in the fifth row, fourth column. The process was repeated for Sunday time blocks, assigning numbers 81 through 160 representing the four possible time blocks within each condition and location.

Random Selection of Cell Numbers

Random number lists were generated from www.random.org, one for 1 through 80, and another for 81 through 160. The lists were without replacement, meaning that each number would only appear once. Alternating between the Saturday and Sunday lists, the number on the list first encountered was matched to the corresponding cell number in the grid, and assignment of a day of week, time, condition, and location was made. If a cell had already been assigned (one of the eight numbers already came up in the random selection process) that cell was excluded (because that condition and location was already accounted for), the number crossed out, and the next number appearing in the randomized list represented the selected day, time, condition, and location. Only one team was assigned to any one weekend (due to travel and staffing costs) and travel time was necessary between a.m. and p.m. blocks for observations at the different trailheads. Specific weekends selected for the study were based on field team availability during the summer season.

Method of Data Collection

Observational records were gathered with continuous monitoring of traffic along each selected point. Each group observed was categorized according to number of members, approximate age categories represented in the group, numbers of males and females in the group, and on/off-trail behavior where possible. Observers also took field notes as the session was conducted, noting weather, level of activity, presence of wildlife, and any factors that might have influenced recreationist behavior.

Before each session began, two versions of the same sign were posted, on iron signposts, at key entrance points to each trail. A digital camera with tripod was then placed

in a strategic location focused along the trail, and two hours worth of digital recordings from each session were taken. This lens view was replicated to the fullest extent possible upon each subsequent observational session at the site. The camera was placed within full view of park visitors, helping to avoid ethical issues regarding secret recordings.[1] Sound was deleted from the recordings upon delivery to the research office in order to preserve the privacy of the field team.

Each tape was transferred to computer and then transferred onto DVDs. The software and hardware descriptions and further description of the transfer process are available upon request.

Field Notes

The field notes were entered as Microsoft Word documents after review by the principal investigator.

Field Logs

Data from each field log was entered into an SPSS file, and each entry was verified for accuracy by the principle investigator.

DVD Recordings

Each DVD held a two-hour session, with 20 sessions total. Each of these 20 sessions was then sent to two coders. Each coder received a set of five to seven DVDs, coding sheets, and instructions. Coders were blind to the experimental hypotheses and study purpose. Coders watched the simplest DVDs first (based on the fewest recreationists observed for that session as recorded in the field logs) and proceeded to the most complex (the most recreationists observed in a two-hour session). Coding was done independently in private and the DVDs remained secure during the coding phase. Coders signed privacy agreements.

A total of five coders were used across two batches of coding. No coder was assigned more than three DVDs for the same trail, and no more than three DVDs from the same experimental condition.

Each DVD was sent out to two independent coders. Each DVD was also assigned to an in-house arbitration coder, who also coded each session. This step ensured that lack of familiarity with the settings on the part of the independent coders, and unclear camera views, did not lead to errors in coding of off-trail use. This was done to address concern over a few camera views that prevented clear-cut determination of trail boundaries. Since in-house staff had also been the majority of the field crews out conducting the experiments, they were only assigned DVDs that were not from sessions they were responsible for in the field.

Coders were trained in advance of receiving their coding sets through in-depth conference call or in-person training sessions. During the sessions the coding sheets and cat-

[1] While placing the camera in full view of visitors resolved ethical concerns it presented a potential impact on recreationists' off-trail hiking. The expected direction of effect was a possible reduction in off-trail hiking, however this was not measured. Since the camera was in full view across all conditions its effect was held constant.

Item	Categories
Event	Walking on trail
	Walking off trail within 12 inches of trail
	Walking off trail beyond 12 inches of trail
Activity	Walking/running
	Picking up natural objects (e.g., sticks)
	Touching natural features (e.g., trees)
	Throwing/dropping objects
	Taking photographs/posing for photographs
	Climbing/sitting on railing
	Climbing/sitting on built feature (not railing)
	Climbing/sitting on natural feature/object
	Reading signs
	Carving/marking on tree or other natural feature
	Carving/marking on built structure
	Other (specify)

Table 2. Event and Activity Categories Used in DVD Coding Process

egories were reviewed, along with the procedures for progressing from the simplest to the most complex DVDs. Instructions were given regarding receipt and return of the materials to be coded. Coders were reminded that although DVDs could be watched using either a computer with a DVD player or a stand-alone DVD player, devices could vary in their recording of time, especially if the coder needed to scan back and forth across a section of recording or to freeze sections. Because of this coders were encouraged to verify the timing of events as they were coding each session. Finally, coders were instructed to contact the principle investigator as questions arose during the coding process. Questions raised during the coding process were shared by e-mail with all other

coders, along with a response from the principal investigator.

Coding was conducted for each of the following variables: ID number, time, person type, mobility, event, and activities. "ID number" was a subsequent numbering of each person appearing in the screen. Multiple appearances of the same person were possible. The rule given to coders was that if the individual was out of the frame for more than 10 minutes they would be entered as separate appearances. However, if multiple appearances occurred within less than a 10-minute period all appearances would be considered as one, and all activities would be coded into a singular line for that individual. "Time" was recorded in minutes from the start of the DVD and was noted at the first appearance of each individual. "Person" was the coder's best guess on gender and age group (over 16 years old, 16 or younger, or infant that could not be classified as male or female). (The 16-year-old cutoff was selected based on prior field experience demonstrating that field team observers are able to determine whether individuals are younger than, or older than 16, with a fair degree of confidence.) "Event" was divided up into three categories (Table 2) addressing whether the person was on or off trail. "Activity" allowed for up to six individual actions for each person observed and concerned behaviors that took place while on or off trail (Table 2).

The coding process led to three sets of coding sheets from each of the 20 observational recordings (two from the independent coders assigned to that session and one from an in-house arbitration coder). These coding records were entered into a Microsoft Excel spreadsheet, and matches and mismatches were identified within each set. The principal investigator then reviewed each instance of a mismatch by viewing the applicable DVD and making a final determination of the appropriate codes. Following this review, each of the verified cases was corrected as necessary, and the file transferred over to SPSS.

Inter-rater reliabilities were calculated based on agreement of overall entries on the coding sheets, as well as agreement on each key aspect of the final DVD codes including person type, mobility, event (on or off trail), and activities observed. The range shows the lowest and highest reliabilities across all 20 sessions within each variable type. Average reliabilities were satisfactory within each category ranging from a low of 0.859 to a high of 0.986 (Table 3).

Results

In total, 2,897 recreationists were observed and coded from the DVDs for this study. The number of people observed at each trail location varied, with Grant Grove showing the highest level of visitation during the observational sessions (Table 4). These variations reveal the diversity in levels of use across the sites selected.

The number of recreationists observed also varied by time of day (Table 4). The most recreationists were observed in the early afternoon (between 13:30 and 15:30).

The total number of recreationists observed on Saturdays (1,480) was greater than on Sundays (1,059). Finally, the number of recreationists observed varied by condition, with the fewest observed in Condition IV (Table 4). The randomization of each observational session across day, time, and site helped to reduce concerns over these variations.

The number of people observed going off-trail varied significantly by experimental condition ($\chi^2_{4,\, n=2,838} = 149.26$, $p < .01$). The greatest proportion of off-trail use occurred in the control condition (Condition V, when no additional sign was added, fig. 2)

	Person Type	Mobility	Event	Activity
mean	0.913	0.986	0.859	0.906
SD	0.048	0.027	0.122	0.041
range	0.794-0.979	0.882-1.0	0.629-1.0	0.818-0.967

Table 3. Inter-rater Reliabilities by Variable Coded

Location	Number of Recreationists
Congress Trail	1,012
Big Trees Trail	446
Crescent Meadow	385
Grant Grove	1,054
Time of Day	
8:30 to 10:30	426
10:30 to 12:30	695
13:30 to 15:30	1,167
15:00 to 17:00	609
Condition	
Injunctive-Proscriptive (I)	602
Descriptive-Proscriptive (II)	659
Injunctive-Prescriptive (III)	665
Descriptive-Proscriptive (IV)	373
Control (V)	598

Table 4. Number of Recreationists Observed by Location, Time of Day, and Condition

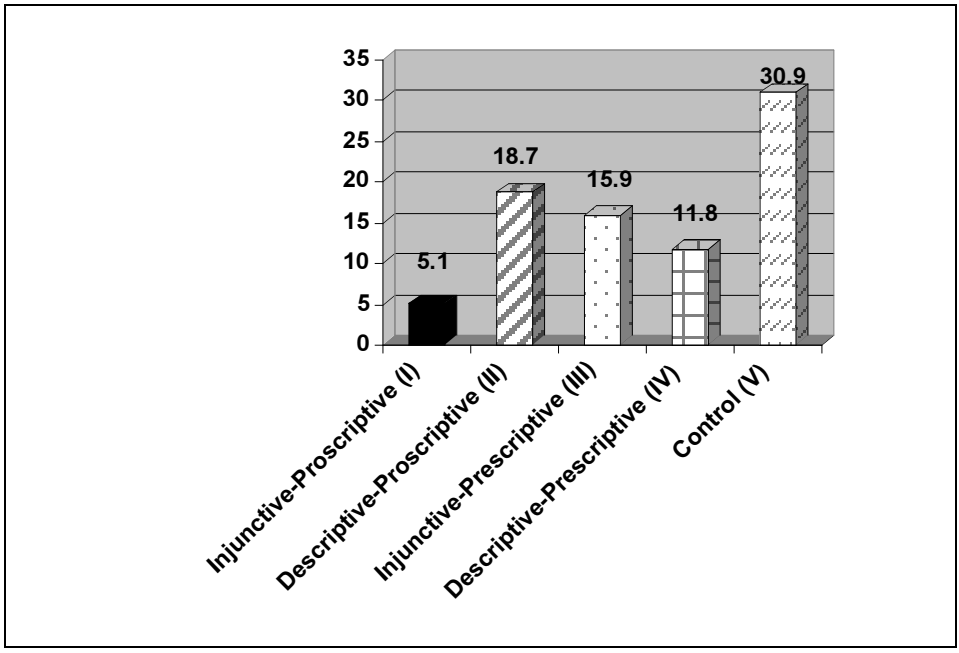

Figure 2. The Proportion of Recreationists Observed Going Off Trail by Condition

The least off-trail use in any experimental condition occurred under the Injunctive-Proscriptive condition (Fisher's exact test, $p < .01$; in Condition I = 5.1 percent of people observed went off trail, vs. all other experimental conditions where 16.1 percent of people observed were off trail). The highest incidence of off-trail use occurred under the Descriptive-Proscriptive condition (Condition II with 18.7 percent of people observed off trail), compared to all other experimental conditions (11.0 percent went off trail, Fisher's exact test, $p < .01$).

Instructing visitors to stay on the trail appeared to be much less effective than an admonishment against going off trail (Fisher's exact test, $p < .01$). Visitors were three times less likely to go off trail when the Injunctive-Proscriptive message (5.1 percent in Condition I, "Please don't go off the established paths and trails, in order to protect the Sequoias and natural vegetation in this park") was posted than when the Injunctive-Prescriptive message (15.9 percent in Condition II, "Please stay on the established paths and trails, in order to protect the Sequoias and natural vegetation in this park") was posted.

However, in the case where the behavior of others was presented, it seemed better to describe the desired behavior than the undesirable one. When comparing the Descriptive-Proscriptive message ("Many past visitors have gone off the established paths and trails, changing the natural state of the Sequoias and vegetation in this park") and the Descriptive-Prescriptive message ("The vast majority of past visitors have stayed on the established paths and trails, helping to preserve the natural state of the Sequoias and vegetation in this park"), the Proscriptive form (Condition II at 18.7 percent) was associated with significantly greater off-trail use (compared to 11.8 percent under the Prescriptive form).

Likelihood	Activity	Incidence On Trail %	Incidence Off Trail %
Approximately equal	Picking up natural objects	<1	1
	Climbing or sitting on built features	<1	2
	Throwing or dropping objects	<1	<1
	Climbing or sitting on natural features	<1	1
	Climbing or sitting on railings	2	<1
More likely on trail	Walking or running	46	41
	Reading signs	17	6
More likely off trail	Taking or posing for photos	10	18
	Touching natural features	<1	11

Table 5. Activities Engaged in On and Off Trail

Activities Engaged in by Visitors Observed On and Off Trail

In addition to on- and off-trail use, selected activities were noted. A comparison of these activities by visitors on trail and off trail showed that many of the activities were of approximately equal likelihood including: picking up natural objects (Table 5), climbing or sitting on built features, throwing or dropping objects, climbing or sitting on natural features, and climbing or sitting on railings. Two activities were more likely among those staying on the trail, including walking or running, and reading signs. Among those going off trail, taking or posing for photographs, and touching natural features were more likely. The natural features touched most often were the Sequoias.

These patterns match informal observations about motivators that seemed to influence off-trail use. People going off trail were frequently seen posing for photographs, or taking photographs. There were many groups of hikers that gathered around and in front of Sequoias to pose for pictures. Others were seen going up to Sequoias to touch the bark, walk around the trees, and sometimes to wrap their arms around the trees.

At Crescent Meadow the off-trail use was of a different nature. At this site hikers were seen going off trail to take close-up photos of the flowers and insects in the meadow, and at times, especially later in the summer, to walk across the meadow to the logs in the center. Walking through the meadow more often later in the summer seemed to be in part because of the trampled vegetation, indicating the presence of past hikers who had taken the same route. This evidence of off-trail use was potentially quite powerful, sending the message that the norm was to go off trail (see Cialdini, Kallgren, & Reno, 1991 for evidence of this effect). Off-trail use was noted even among those who were directly

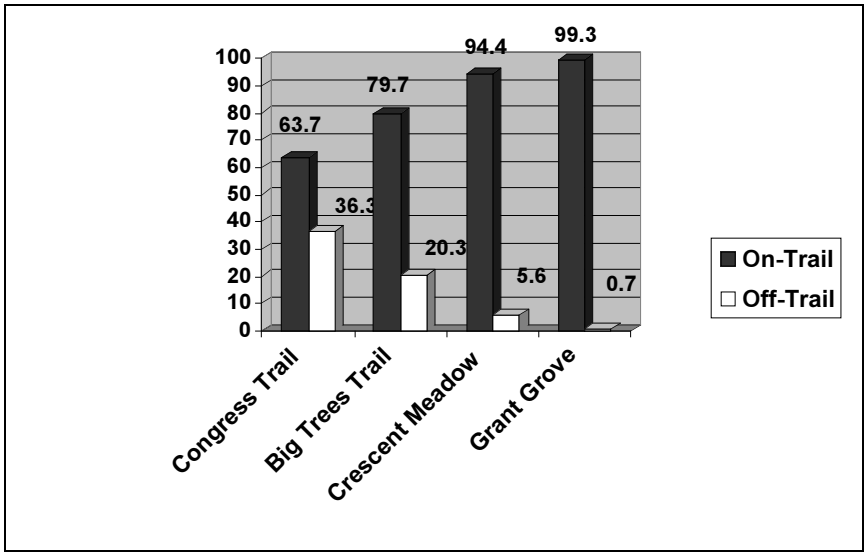

Figure 3. The Proportion of Visitors Observed On and Off Trail by Site

observed reading the sign that included information about staying on the trail.

Another example of physical traces observed in the park was the footprints in the dirt off trail, and sometimes the dramatically worn-down areas of dirt and small plants. Interestingly enough, the park signs suggesting people stay off the wildflowers and other plants seemed to encourage people to step around the plants while they were off trail (the actual sign read, "Give Plants a Chance Please Keep Off" and was paired with a graphic of a shoe situated above some plants and a red circle and line through the middle of the graphic).

On other occasions, the observational teams noticed that when hikers entered an area, if others were already off trail in the setting, it seemed more likely that the newcomers would go off trail as well.

A final issue that presented itself during this study was the lack of clarity between what was on and off trail. At Crescent Meadow if a hiker entered the area from the southern end of the meadow, traveling through the picnic site first and then heading northwest, the path wound around the trees and up against the meadow, sometimes passing directly over roots of the Sequoias. If a hiker only traveled along the southeast to the northeast edge of the meadow, the experience was quite different in that much of the way was paved. In addition, the instruction to enter the meadow by walking across the logs seemed a bit confusing, as people crossed the meadow from the point of observation directly to the logs.

At Congress Trail there was the impression relayed in conversation and through behaviors observed that since the railing was not present as it was around the General

Sherman tree and the main path, that walking through the dirt and around the trees was acceptable.

An examination of the proportion of visitors observed on and off trail also speaks to the impact of site features, such as railings and the factors mentioned above (fig. 3).

It should be noted that observers and DVD coders were instructed to watch for other depreciative behaviors, such as littering, carving or spraypainting on trees or other surfaces, and causing other forms of environmental damage. These activities were not seen at all in the full 40 hours of recordings.

Discussion and Conclusions

This study was conducted in order to examine the effectiveness of selected messages in signs, contrasting four normative message types. In keeping with past research conducted at the Petrified Forest (Cialdini et al., 2006), the injunctive-proscriptive message was the most effective normative message in discouraging off-trail use by recreationists. This message politely presented an admonishment against the undesired behavior (basically, "Please don't go off the trail"). Second in effectiveness was the descriptive-prescriptive message, which stated the desired behavior as the norm (a short version would be "Most visitors stay on the trail"). Third in effectiveness was the injunctive-prescriptive message, (basically saying "Stay on the trail"). The least effective message of the four tested was the descriptive-proscriptive message, which presented the undesirable behavior as the norm. The reader will note that all four messages included a very brief justification for the behavior.

The contrast between the prescriptive and proscriptive message forms is of special interest. While interpreters may prefer prescriptive messages (Winter et al., 2000), the power of the negative statement may lie in its ability to be more memorable. Bad or negative information is more thoroughly processed and remembered than is positive information (Baumeister et al., 2001). Setting up the proscriptive-descriptive message might be particularly powerful in eliciting an undesirable action because of this effect, paired with the effect of presenting the undesirable behavior as the norm, thereby invoking the principle of social proof (Cialdini, 2001).

Renovations at the Congress Trail that have occurred since the experiment was conducted may have altered the behavioral patterns observed at that site. The sites with the greatest levels of off-trail use might be good candidates for further interventions through site modification, signage, and placement of volunteers or other uniformed personnel who could remind visitors to stay along the designated trail, or preferably, not to go off. These contacts should probably follow the same principles as those discovered in this test of signs, that is, the emphasis should either be on "not going off trail" or, if the preference is towards describing the actions of others, "the vast number of visitors stay on the trails and paths."

These findings are instructive because they point resource managers towards the selection of the most effective wording in signs. Messages that are focused on rules and regulations are ideally brief in their informational presentation, are polite (adding "please") and that present a succinct statement about *not* doing a particular action. In contrast, the least effective would be those that present undesirable behaviors as occurring frequently. While there have been a number of studies conducted on signage and messages that should be contained in signs, studies have often, upon replication, led to mixed results (Widner & Roggenbuck, 2000). This line of inquiry has been replicated beginning with the work reported by Cialdini and others (2006) and continuing with the

present study, with a similar pattern of results across both studies in different settings with different focal behaviors. One of the key benefits of the particular approach examined is that its content is free of threats of punishment or offerings of incentives, both which are difficult to maintain and whose effects tend to be short-lived (Geller, 2002).

Future replications are of interest with different types of recreation-use groups, and in settings that are outside of National Parks to continue to refine the understanding of applying normative message framing to real publics. As suggested by Gramann (2000) urban settings may reveal a different prescription for effective signage. In addition, it might be helpful to add an additional layer to the normative message, combining the prescriptive-descriptive message and the proscriptive-injunctive message into one sign (based on conservation research by Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2005). While it would be crucial to continue to keep messages brief and easy to understand (Nickerson, 2003), the expectation is that this combination would be more effective in reducing depreciative activities than would use of either of the normative message approaches alone. It should be noted however that the signage along the trail is a situation in which the appropriate behavior is desired within a very brief time period from exposure to the message. In cases where longer-term maintenance of actions is desired, making immediate prompts impractical, other interventions should be employed (Manning, 2003). Examples of these other interventions would be conservation and environmental education efforts onsite, offered through visitor centers and interpretive programs, as well as conservation education within schools. Such efforts work to build an enduring and personally held land ethic.

References

Baumeister, R.F., Bratlavsky, E., Finkenauer, C., Vohs, K.D. (2001). Bad is stronger than good. *Review of General Psychology*, 5(4): 323-370.

Chavez, D.J. (1996). *Mountain biking: Issues and actions for USDA Forest Service managers.* Research Paper PSW-RP-226. Pacific Southwest Research Station, USDA Forest Service, Albany: CA.

Chavez, D.J. (2001). *Managing outdoor recreation in California: Visitor contact studies 1989-1998.* General Technical Report PSW-GTR-180. Pacific Southwest Research Station, USDA Forest Service, Albany: CA.

Cialdini, R.B. (1996). Activating and aligning two kinds of norms in persuasive communications. *Journal of Interpretation Research*, 1(1): 3-10.

Cialdini, R.B. (2001). *Influence: Science and practice.* (4th ed.). Needham Heights, MA: Allyn & Bacon.

Cialdini, R.B., Barrett, D.W., Bator, R., Demaine, L., Sagarin, B J., Rhoads, K. L., Winter, P.L. (2006). Managing social norms for persuasive impact. *Social Influence*, 1(1): 3-15.

Cialdini, R.B., Kallgren, C.A., Reno, R.R. (1991). A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. *Advances in Experimental Social Psychology*, 24: 201-234.

Cialdini, R.B., Reno, R.R., Kallgren, C.A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 58(6): 1015-1026.

Cvetkovich, G.T., Winter, P. (1998). *Community reactions to water quality problems in the Colville National Forest: Final report*. Unpublished technical report. Bellingham, WA: Western Washington University.

Cvetkovich, G.T., Winter, P.L. (2002). *Social trust and the management of threatened and endangered species: A study of communities of interest and communities of place.* Res. Paper PSW-RP-247. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 65p.

Dilsaver, L.M., Tweed, W. C. (1990). *Challenge of the big trees.* Three Rivers, CA: Sequoia Natural History Association, Inc.

Geller, E.S. (1992). Solving environmental problems: A behavior change perspective. In S. Staub & P. Green (Eds.) *In our hands: Psychology, peace, and social responsibility* (pp. 248-268). New York, NY: New York University Press.

Geller, E.S. (2002). The challenge of increasing proenvironmental behavior. In R. B. Bechtel & A. Churchman (Eds.) *Handbook of environmental psychology* (pp. 525-540). New York, NY: John Wiley & Sons, Inc.

Gramann, J.H. (2000). Protecting park resources using interpretation. *Park Science*, 20(1): 34-36.

Johnson, D.R., Vandekamp, M.E., Swearingen, T.C. (1994). *A survey of park managers/ perceptions of noncompliant visitor behavior causing resource damage in the National Park system.* Technical Report NPS/PNRUW/NRTR-92-07.

Kuo, I.-L. (2002). The effectiveness of environmental interpretation at resource-sensitive tourism destinations. *International Journal of Tourism Research*, 4: 98-101.

Lackey, B.K., Ham, S.H. (2003). Contextual analysis of interpretation focused on human-black bear conflicts in Yosemite National Park. *Applied Environmental Education and Communication*, 2: 11-21.

Manning, R.E. (2003). Emerging principles for information/education in Wilderness management. *International Journal of Wilderness*, 9(1): 20-27 and 12.

Marin, G. (1994). Self-reported awareness of the presence of product warning messages and signs by Hispanics in San Francisco. *Public Health Reports*, 109(2): 275-283.

McCool, S.F., Cole, D.N. (2000). Communicating minimum impact behavior with trailside bulletin boards: visitor characteristics associated with effectiveness. In D.N. Cole; S.F. McCool; W.T. Borrie; J. Loughlin (Compilers) *Wilderness science in a time of change conference-volume 4: Wilderness visitors, experiences and visitor management* (pp. 208-216). 1999, May 23-27; Missoula, MT. Proceedings RMRS-P-15-VOL-4. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Nickerson, R.S. (2003). *Psychology and environmental change*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Publishers.

Reno, R.R., Cialdini, R.B., Kallgren, C.A. (1993). The transsituational influence of social norms. *Journal of Personality and Social Psychology,* 64(1): 104-112.

Roggenbuck, J.W., Widner, C.J., Stratton, D.W. 1997. *Reducing theft of petrified wood at Petrified Forest National Park.* Unpublished report. Department of Forestry, Virginia Tech, Blacksburg, Virginia.

Schultz, P.W. (1998). Changing behavior with normative feedback interventions: A field experiment on curbside recycling. *Basic and Applied Social Psychology,* 2(1): 25-36.

Schultz, P., Nolan, J.M., Cialdini, R.B., Goldstein, N.J., Griskevicius, V. (2005). *Descriptive normative beliefs, normative feedback, and behavior.* Unpublished manuscript.

Stynes, D., Sun, Y.Y. (2003). *Impacts of visitor spending on local economy: Sequoia and Kings Canyon National Parks, 2002.* Available at: www.nature.nps.gov/socialscience/docs/MGM_SEDI.pdf.

Tynon, J.F., Chavez, D.J., Harding, J.A. (1997). *National recreation trails: A comprehensive nationwide survey.* Unpublished technical report. Orono, Maine: University of Maine and USDA Forest Service.

Ward, C.J., Martin, S.R., Absher, J.D., Newman, D.M., Tarlton, J.L. (2003). *Interpretation effectiveness at Taylor Creek Visitor Center*. Unpublished technical report, Pacific Southwest Research Station, USDA Forest Service.

Widner, C.J., Roggenbuck, J. (2000). Reducing theft of petrified wood at Petrified Forest National Park. *Journal of Interpretation Research,* 5(1): 1-18.

Winter, P.L., Cvetkovich, G.T. (2003). *A study of southwesterners' opinions on the management of wildland and wilderness fires: Fire management version*. Available at: www.myfirecommunity.net/documents/SDSU_tech_02_fire_FMO_eversion.pdf.

Winter, P.L., Cialdini, R.B., Bator, R.J., Rhoads, K., Sagarin, B.J. (1998). An analysis of normative messages in signs at recreation settings. *Journal of Interpretation Research,* 3(1): 39-47.

Winter, P.L., Sagarin, B.J., Rhoads, K., Barrett, D.W., Cialdini, R.B. (2000). Choosing to encourage or discourage: Perceived effectiveness of prescriptive and proscriptive messages. *Environmental Management,* 2(6): 588-594.

Wirsching, A., Leung, Y.F., Attarian, A. (2003). Swatting litter bugs. *Parks & Recreation,* 38(11): 16, 18-22.