

WILDERNESS MANAGEMENT THROUGH VOLUNTARY BEHAVIOR CHANGE: AN EVALUATION OF THE PEMIGEWASSET WILDERNESS MANAGEMENT PLAN

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The management plan for the Pemigewasset Wilderness Area of New Hampshire represents a departure from traditional plans. Results of this study indicate limited evidence of the Pemigewasset Wilderness Management Plan (PWMP), as currently implemented, having a large direct impact on diverting hikers from their planned destinations and promoting dispersed usage and low impact camping.

Wilderness Management

The Wilderness Act of 1964 states that the principal value of wilderness is the protection of areas which "generally appear to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable" and that "it is the policy of Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness" (PL 88-577, Section 2A). A multitude of uses, outside influences, and legal mandates make management of the nation's 90,000,000 acres of wilderness areas necessary (Lucas and others 1985). While the Act establishes general guidelines for the management of wilderness areas, it leaves the development and implementation of specific management objectives to the individual federal agencies governing each designated area. Management techniques may be grouped into five broad areas (Lucas and others 1985): required permits; fees charged for area use; open access, with no fees or permits required; restricted use of certain areas; and open access systems which seek to voluntarily change use patterns. We focus on the last technique.

The Study Area

In 1984, 45,000 acres of the White Mountain National Forest in New Hampshire were designated by Congress as the Pemigewasset Wilderness, the largest tract in the National Wilderness Preservation System east of the Mississippi. Served by 11 trails totalling approximately 45 miles, the area is estimated to generate 19,000 recreation visitor days per year (USFS 1989).

In order to address the unique mix of historical and physical characteristics within the Pemigewasset Wilderness the management plan implemented by the Pemigewasset National Forest Ranger District divides the area into separate "zones," each with a specific management strategy. Areas where heavy use requires "active management to restore and maintain the wilderness condition" are designated as "Zone C" (USFS 1989). The implicit assumption made by the Forest Service is that dispersed usage is preferable to concentrated usage in meeting the Wilderness Act's goals. Previous studies have found that visitor usage is highly concentrated in most wilderness areas (Lucas and others 1985; Hendee and others 1978), that solitude is a quality sought by many wilderness users (Hampton and Cole 1988; Lucas and others 1985), and that the quality of the experience declines in the presence of other people (Lucas 1980; Roggenbuck and Berrier 1982). Hence, unmanaged use patterns are tending to cause the very situation that visitors to wilderness areas seek to avoid. An increasing number of studies have also suggested that the growing number of wilderness users are causing considerable physical damage to the natural resource (Cole 1989; GAO 1989). Based on this information, it appears that diverting overnight hikers to less traveled parts of the wilderness should increase total utility generated from the PWA.

The management plan for Zone C incorporates an innovative strategy with two components: 1) an active wilderness education program; and 2) a system of managed, designated, and dispersed camp sites. A central feature of the program is the use of "wilderness rangers" who promote dispersed camping, wilderness ethics, and the "no trace" camping ethic. These rangers contact hikers on the trail and provide information in hopes of persuading hikers to frequent less used areas and use lower impact hiking and camping practices, helping to mitigate many problems of overuse. Zone C is thus a "field school" where users learn low impact skills and wilderness values which can be carried to more remote parts of the PWA.

The Survey

In order to determine whether the PWMP was effective in altering backcountry users' behavior, a survey of area users was conducted in summer of 1989. The self-administered survey collected data on users' ages, incomes, environmental attitudes, reasons for visiting the area, and party characteristics. A total of 281 survey interviews were completed. Of these 281, 84 were hikers who had been contacted by wilderness rangers in Zone C; this group forms the basis for this analysis.

Information Obtained by Survey Respondents

A prime objective of the PWMP was to transmit information on low impact camping techniques and wilderness ethics. However, when asked to describe "helpful" information they received from the wilderness ranger, most respondents noted area- or trip-specific information such as camping sites (25.8 percent), weather (9.7 percent), points of interest (8.6 percent), and trail conditions (7.5 percent). Only one respondent (1.1 percent) related receiving helpful information on low impact camping techniques.

The Models

Prior to conducting the survey, two logit models were constructed to evaluate the effectiveness of the PWMP. The first or "behavior change" model examined the probability that respondents who had been contacted by a wilderness ranger changed their destination. Responses to the question "Did you change your original plans as a result of this (wilderness ranger) information?" ranged from not at all to slightly (dependent variable = 0) or moderately to greatly (dependent variable = 1). The second model, the "useful information" model, examined factors which determined whether respondents considered the information provided by the rangers as "useful." The question "Do you think that you will use this information on future trips?" similarly ranged from not at all to slightly (dependent variable = 0) or moderately to greatly (dependent variable = 1).

Previous research on characteristics of backcountry users has focussed on age, experience, occupation, education, gender, and group size (Leonard and others 1978; Echelberger and Moeller 1977). This information was used to guide selection of the models' explanatory variables: total number of hikers in party (TOTAL); number of children in party (KIDS); previous plans to stay at a designated tent platform site (1 if planned to stay at platform, 0 otherwise)(PLAT); number of previous visits to area (VISIT); age of respondent, in years (AGE); self-assessed experience of respondent (1 = beginner [EX1], 2 = intermediate [EX2], 3 [EX1 = EX2 = 0] = expert); education level of respondent (1 if college graduate, 0 otherwise)(EDUC); income of respondent, in \$10,000 increments (INC); and likelihood of visiting the area again in next five years (1 if likely, 0 otherwise)(FUTU).

Results

The Behavior Change Model

Eighteen of the 84 respondents indicated that they had changed their destination as a result of the information obtained from the wilderness rangers. Results of the first model are presented in Table 1. Three variables--total number in party, likelihood of future use, and beginner-level experience--were statistically significant. The sign of the TOTAL variable indicates that hikers in large parties were more likely to change their destinations than those in smaller parties. This is an encouraging result, since diverting larger parties could substantially reduce environmental impacts in heavily used areas.

The sign and significance of the experience variable indicate that those with less developed camping skills (about 8 percent of respondents) were more likely than either intermediate or expert hikers to be influenced by the information provided. Backcountry users who were more likely to return (about 51 percent of the total) found the information influential in altering their destinations.

The McFadden R^2 of .193 indicates that the independent variables explain about 19 percent of the variation in the dependent variable. However, using a 50/50 criterion, the model predicts about 84.5 percent of responses correctly. (Under this test, predicted values of greater than .5 are assigned a value of 1, with 0 value otherwise. These assigned values are then compared to actual responses in the prediction success table).

Table 1. Factors influencing change in respondents' wilderness destination. Dependent variable = information provided caused respondent to change destination.

Maximum Likelihood Estimates			
Variable	Estimated Coefficient	Standard Error	Asymptotic T-Ratio
TOTAL	0.554	0.294	1.880*
KIDS	-1.508	1.130	-1.334
PLAT	-0.362	0.644	-0.563
FUTU	1.599	0.738	2.167**
VISIT	0.017	0.058	0.296
EX1	2.250	1.356	1.659*
EX2	1.235	0.907	1.361
AGE	0.005	0.037	0.147
EDUC	0.782	0.718	1.090
INC	0.139	0.159	0.874
CONSTANT	-5.499	2.111	-2.605***

* = significant at .10 level

** = significant at .05 level

*** = significant at .01 level

n = 84 McFadden R-Square: 0.193

Prediction Success Table			
Predicted	Actual		
	0	1	
0	64	11	
1	2	7	
Number of Right Predictions: 71.0			
Percentage of Right Predictions: 84.5			

Calculation of Probability Estimates

One of the attractive features of logit analysis is that it allows prediction of individual behavior based on different values of the independent variables (Capps and Kramer 1985). The probability that an individual with mean characteristics would change behavior due to information provided is approximately 14.3 percent. Thus, the information program is effective in diverting less than one-seventh of those contacted from their original destinations in zone C. When considering only experts (that is, EX1 = EX2 = 0, 21 of the 84 surveyed), the probability of changing destinations is only about 5.7 percent. Given these results, it appears that the PWMP is not very effective at redirecting hikers from Zone C.

The Useful Information Model

Despite the results of the behavior change model, the program might still be considered a success if hikers used the information obtained on future trips. If this were the case, over the long run dispersed usage might be achieved. For this reason, the model attempted to determine whether hikers would use the information provided by the wilderness rangers in the future.

Sixty-four of 84 respondents indicated that they found the information provided by the rangers helpful. As noted previously, however, most of this information was site- or area-specific, and not directly related to the objectives of the PWMP.

Table 2. Factors influencing usefulness of information provided. Dependent variable = respondent's perception that information was helpful.

Maximum Likelihood Estimates			
Variable	Estimated Coefficient	Standard Error	Asymptotic T-Ratio
TOTAL	0.965	0.482	2.001**
KIDS	-0.531	0.573	-0.927
PLAT	-1.336	0.829	-1.612
FUTU	3.439	0.974	3.352***
VISIT	0.031	0.043	0.719
EX1	2.239	1.684	1.329
EX2	0.641	0.801	0.799
AGE	0.175	0.064	2.720***
EDUC	-1.447	1.008	-1.434
INC	0.139	0.163	-0.183
CONSTANT	-0.030	2.111	-2.605***

** = significant at .05 level

*** = significant at .01 level

n = 84 McFadden R-Square: 0.375

Prediction Success Table			
	Actual		
		0	1
	0	11	6
Predicted	1	9	58
Number of Right Predictions: 69.0			
Percentage of Right Predictions: 82.1			

Results of the second model are presented in Table 2. A total of three variables were statistically significant at or beyond the .05 level: total number in party, likelihood of future use of the area, and age. The FUTU variable is especially interesting given the magnitude of its coefficient (3.44). About 51 percent of respondents indicated that they were likely to return to the Pemigewasset; hopefully, they will use the information received on these later trips. Older respondents and those from larger parties were more likely to find the information helpful. The sign of the platform variable implies that hikers who camp at the tent platform sites in the PWA are less flexible about changing their behavior. Unlike the behavior change model, the experience variables apparently play little role in determining whether the information provided will be used in the future.

The McFadden R^2 for the model was .375, indicating a moderate amount of explanatory power. Using the 50/50 criterion outlined in the preceding section, the model was able to successfully predict about 82 percent of the actual responses.

Calculation of Probability Estimates

Following procedures outlined above, the probability that an individual with mean characteristics would find the information helpful is about 90 percent. Further analysis of the results indicates that the program is more effective in influencing returning hikers. For hikers who answered that they were not likely to return (about 49 percent of the total), the probability of judging the information helpful was only 60 percent. When one considers the group likely to return, this percentage increases to nearly 98 percent. The differences in these two probabilities can be attributed to the area-specific information provided by the PWMP, which will not be used again by those

not returning to the area. Finally, for the expert hiker group, the probability of judging the information helpful was about 82 percent, indicating that even expert hikers perceive benefits from the information provided.

Conclusions

Results of this study indicate that there is at best limited evidence of the PWMP, as implemented in the summer of 1989, having a large direct impact on diverting hikers from their planned destinations. Less than 20 percent of hikers contacted intended to change their camping destinations due to the information obtained from wilderness rangers. Respondents' accounts of what information received was "helpful" indicated that the information on low impact camping and wilderness ethics which will hopefully divert hikers from heavily used areas is not being transferred, a conclusion reinforced by logit results. This may indicate a need for changed emphasis in the information provision techniques of the wilderness rangers. Despite this, there is evidence of a substantial amount of information being disseminated to users of the PWA. Similarities among PWA and other wilderness area users (see Brown and others 1991) indicate that what is successful in the PWA may well prove successful elsewhere. It seems evident that the PWMP is effective at information provision on the area; whether this proves effective in managing our wilderness areas remains to be seen.

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