MINOR RULE VIOLATORS: A PROFILE OF OFF-TRAIL HIKERS, PARADISE MEADOWS, MOUNT RAINIER NATIONAL PARK

MINOR RULE VIOLATORS: A PROFILE OF OFF-TRAIL HIKERS, PARADISE MEADOWS, MOUNT RAINIER NATIONAL PARK

Subagreement No. 10

Co-op Agreement No. CA-9000-3-0004

A Study of Visitor Noncompliance
with Minimum Impact Behavioral Expectations
in Paradise Meadows, Mount Rainier National Park

Submitted by

Darryll R. Johnson
Project Leader

and

Thomas C. Swearingen
Research Assistant

National Park Service
Cooperative Park Studies Unit
College of Forest Resources
University of Washington
Seattle, Washington 98195

February, 1988

TABLE OF CONTENTS

LIST OF TABLES

1987 Paradise Meadows Visitor Survey

EXPOSURE TO VISITOR IMPACT OR MINIMUM IMPACT GUIDELINES

PERCEPTION OF HUMAN IMPACT PROBLEM

ATTITUDE TOWARD OFF-TRAIL HIKING & ASCRIPTION TO AGENCY NORMS

SUMMARY OF BIVARIATE TABLES AND DISCRIMINATE ANALYSIS

INTRODUCTION

As a background to this report, a brief discussion of the 1987 Mount Rainier National Park (MORA) Paradise Meadows Visitor Survey (PMVS) is presented. The PMVS was funded by Mount Rainier National Park and the Cooperative Park Studies Unit (CPSU) at the College of Forest Resources, University of Washington. This study was based on preliminary studies in 1985 (Johnson and Swearingen, 1986; Swearingen and Johnson, 1986).

The primary purpose of the 1987 survey was to develop a descriptive profile of the off-trail hiking population at Paradise Meadows. Data were collected to determine: (1) the level of exposure of Paradise Meadows visitors to information on human impact on the natural environment or low impact use guidelines, (2) visitors' exposure in the Park to various media and facilities disseminating information related to human impact and low impact use guidelines, (3) visitors' knowledge of and attitudes toward low impact guidelines for the Paradise day use area, (4) certain attitudes and other cognitive variables relating to the natural environment, (5) visitor perceptions of the human impact problem in the Paradise Meadow, and (6) selected demographic characteristics.

Development of the Questionnaire

In early 1987, meetings were held between the MORA and CPSU staffs to clearly define the research objectives. A draft questionnaire was then developed by the CPSU based on input from

these meetings and the 1985 survey instrument (Swearingen and Johnson, 1986). Following a pretest in the park, the final questionnaire was mailed to visitors contacted during the summer of 1987.

Sampling and Visitor Contact Procedures

Sampling for this analysis occurred at two sites. The first site was in the lower meadow. The second site was adjacent to the Dead Horse Trail.[1] The selection of these sites was dictated by criteria from the experimental sign study which was administered simultaneously.[2] Two employees were present at the study sites. One inconspicuously recorded selected characteristics of visitors and whether or not they engaged in off-trail hiking for the experimental sign study. The other employee was also stationed so that off-trail hikers could be identified but subsequently made visitor contacts for the survey.

A schedule was designed to randomize sampling by site, treatment, time of day, and day of the week. All visitors over the age of 16 who deviated from the trial at the study sites were considered to be noncompliers and were included in the survey sample. Every nth complier over the age of 16 was also contacted and included in the sample. The procedure of choosing every nth complier created a representative sample of compliers to be used for statistical comparison with noncompliers. There was some

1 These sites and the rationale for their selection are discussed in more detail in Swearingen and Johnson, 1988.
2 See Swearingen and Johnson, 1988.

adjustment to the schedule to ensure that the subsamples of compliers and noncompliers were roughly equal.[3]

Visitors selected to participate in the survey were approached for a brief interview. If the interviewee had been contacted at another study site, the person was courteously thanked, and the interview terminated. The interview consisted of an introduction, an explanation of the nature of the research, and a request for participation in a mail survey. Those visitors who agreed to participate completed an on-site form (Appendix A). A questionnaire was then mailed to them from the University of Washington (Appendix C). Behavioral and other administrative data were coded on the site sheet by the CPSU employee.

Assuming no response bias and subject to the statistical data limitations, the samples should be representative of the Paradise visitor subpopulations (compliers and noncompliers) that passed the study sites.

Due to administrative problems and manpower limitations, it was not always possible to have two observers at the barrier sites and Panorama Point. In such situations, visitor contacts were limited to what a single person could accomplish, given concurrent responsibilities for recording sign or barrier compliance data. Thus, there is not a perfectly matched sample of compliers and noncompliers at some locations. Questionnaires

---

3 Initially, every 7th complier was contacted. With periodic checks, the complier sample was found to be somewhat larger than desired. Thereafter, every 12th complier was sampled, and another adjustment was made near the end of the season to every 10th complier.

received from people contacted at these sites are not included in analyses for this report.

There were also contacts near the experimental sites of visitors engaged in depreciative acts not specifically related to the experimental treatments. These visitors were contacted in the same manner as other visitors and asked to complete on-site sheets for inclusion in the questionnaire sample. They are, however, not included in the sample used for this report.

Refusals to participate were recorded in employees' journals. Based on this data, refusals were estimated to include: 20 Americans, 44 Asians (mostly Japanese), and 5 others. Most refusals by Japanese visitors occurred near the trailhead sign on the north side of the Paradise parking lot, and these were contacts by the roving researcher at a specific picnic spot.[4]

Questionnaire Administration

The questionnaire was pretested on-site with an opportunity sample of visitors (n = 55) contacted in the Park at Alta Vista

4 Since the potential number of refusals would be small relative to the sample size, it would be very difficult for the missed contacts to produce a statistically significant difference in mean responses to a given variable for the total sample. The sample size (visitor contacts) was 1661 persons and refusals were 4% of this number. The response rate was lowest for foreign visitors (47.8%) and highest for visitors from Washington state (72%). The reported refusals thus represent an estimated potential respondent loss of 23 foreign persons and 14 Washington state residents. Even if the responses of the 37 persons were radically different from the other visitors, this small number would not have a substantial impact on the descriptive statistical profile of such a large sample. Because of the lower response rates and the higher rates of refusals for foreign visitors, however, the data do not properly represent this group. In addition, because their numbers are so small, it is impossible to compare their responses to those of other visitor groups.

in Paradise Meadow on June 22 and 23, 1987. The pretest results were compiled, and the final version questionnaire produced. The final version was completed and administered by mail from the University of Washington to matched samples of compliers and noncompliers (relative to sign treatments) contacted in the Paradise Meadow area from late June to early September, 1987.

All visitors 16 years of age or over who completed the on-site sheet were mailed a questionnaire (Appendix C). A first reminder/thank you letter was sent to all subjects in the survey (Appendix D). A second reminder letter and a replacement questionnaire were sent only to nonrespondents (Appendix E). Of the 1661 questionnaires distributed to visitors completing an on-site sheet, 38 were eliminated because of bad addresses (many were military personnel), 13 were dropped because the respondent was under 16 years of age, and 4 were dropped because the respondent was an employee of the Park or of a Park concessionaire. A total of 1152 valid questionnaires were returned, resulting in a 72% percent response rate. No questionnaires were accepted after January 25, 1988.

Nonresponse

Although a 72 percent return rate was achieved, it remains that 28 percent of the original sample are not included in the data. It is possible that differential response rates among types of visitor groups could affect the representativeness of the results. A minimal amount of data on each visitor contacted is available from the on-site sheet, thereby making possible some tests for nonresponse bias.

A chi square test of independence (using a .05 significance level) was performed with the responding and non-responding subsamples[5] with the data included on the on-site sheet (Appendix A). It was concluded that there were no significant differences between the two subsamples in terms of the following: (1) location of visitor contact, (2) group structure (i.e., individual, family, friends, family and friends, or organized group), and (3) gender. There was a significant difference in response rates by group size (Table A). The response rate for groups of one to four persons ranged between 71 and 77 percent, while the response rates for larger groups of five or more visitors was lower, ranging from 56 to 71 percent.

There was a significant difference in the age distribution of respondent and nonrespondent groups (Table B). Response rates are lower among younger visitors. Approximately 55 percent of the 16 to 24-year-old age cohort responded to the survey, compared to approximately 81 percent response from those visitors 60 years old and older. Response rates by visitor compliance status were significantly different (Table C). The response rate for compliers was 79 percent; the response rate for noncompliers was 67 percent.

Response rates also differed by place of residence (Table D). Further analysis demonstrates that the statistical

---

5 The significance level is an arbitrary probability at which null hypotheses will be rejected. If the probability of obtaining the chi square statistic is equal to or less than .05, the null hypothesis predicting no difference between the groups is rejected. If the probability of obtaining the chi square statistic is greater than .05, the null hypothesis is not rejected.

significance in Table D is accounted for by foreign visitors.

Table A. Response Rate by Group Size - 1987 Paradise Meadows Visitor Survey.

	RESPONSE CATEGORIES		
	Nonrespondent	Respondent	n
SIZE OF GROUP:			
1	24%	76%	79
2	26%	74%	570
3	23%	77%	241
4	29%	71%	302
5	29%	71%	136
6	32%	68%	87
7	44%	56%	57
8 or more	35%	65%	134
Column Total	28%	72%	1606

Missing Cases = 0
Chi-Square = 15.4 p = .032

Table B. Response Rate by Age - 1987 Paradise Meadows Meadows Visitor Survey.

	RESPONSE CATEGORIES		
	Nonrespondent	Respondent	n
AGE OF INDIVIDUAL:			
16-24 Years	45%	55%	233
25-29 Years	27%	73%	263
30-34 Years	29%	71%	249
35-39 Years	26%	74%	215
40-44 Years	24%	76%	185
45-49 Years	23%	77%	116
50-54 Years	27%	73%	89
55-59 Years	27%	73%	64
60 or More Years	19%	81%	192
Column Total	28%	72%	1606

Missing Cases = 0
Chi-Square = 46.0 p = .000

Table C. Response Rate by Compliance Status - 1987 Paradise Meadows Visitor Survey.

	RESPONSE CATEGORIES		
	Nonrespondent	Respondent	n
COMPLIANCE STATUS:			
Complier	21%	79%	613
Noncomplier	33%	67%	683
Noncomplier-Family	35%	65%	191
Noncomplier-Group	36%	64%	47
Depreciative Behavior	25%	75%	71
Column Total	28%	72%	1605

Missing Cases = 1
Chi-Square = 28.3 p = .000

Table D. Response Rate by Residence - 1987 Paradise Meadows Visitor Survey.

	RESPONSE CATEGORIES		
	Nonrespondent	Respondent	n
RESIDENCE STATUS:			
Local	29%	71%	624
Non-Local WA	29%	71%	305
Out-of-State	24%	76%	584
Foreign Country	52%	48%	88
Column Total	28%	72%	1601

Missing Cases = 5
Chi-Square = 30.88 p = .0000

Limitations

The Paradise Meadows visitor survey has several limitations. First, all surveys assume that respondents give accurate and honest answers to the questions they are asked. Second, the data represent visitors' attitudes and characteristics at a particular point in time (summer, 1988); it is possible that changes could occur at any time. Third, refusals to participate in the survey were much more common among non-English speaking Asian visitors, especially Japanese visitors. In addition, foreign visitors who agreed to participate had lower response rates. Foreign visitors, therefore, are not well represented.

Fourth, the data should be interpreted in view of the somewhat differential response rates by age and group size. Fifth, the data should be interpreted in light of the fact that the sample was not randomly selected from all Paradise Meadow dayhikers. The universe to which generalization is directed is the population of visitors passing the experimental sites. The sample does contain a random sample of compliers passing the experimental sites and virtually all off-trail hikers. Sixth, in an ideal research design created to compare off-trail hikers with other visitors, all persons who engaged in off-trail hiking anywhere in the meadow would be categorized in one group, and all other visitors would be classified in another. Because it is impossible to observe peoples' behavior throughout the meadow, the only practical approach is to classify visitors in accordance with the observed behavior at a small number of sites. However, because not all people who hike off-trail will do so at the

observation sites, the subsample of compliers contains an undetermined number of off-trail hikers. This problem suggests that the observed subsample differences may be smaller than that of the visitor populations to which generalization is directed. It follows then that the strength of the findings and their practical relevance may be understated.

Appendices

Six appendices have been included at the end of this report. Appendix A is a copy of the on-site sheet used during initial visitor contact. Appendix B is the original cover letter that was mailed with the questionnaire. Appendix C is a copy of the questionnaire that was mailed to visitors. Appendix D is the first reminder letter, and Appendix E is the second reminder letter. A "How to Use This Report" section can be found in Appendix F for those readers unfamiliar with statistics or statistical tables.

The numbers of the questions (e.g., Q-15, Q-23) have been included in the following tables so that they can be easily found in Appendices A and C. The reader may find these appendices useful in interpreting the data in this report.

PROFILE OF OFF-TRAIL HIKERS, PARADISE MEADOWS

Variables used to profile off-trail hikers are listed and discussed below. These variables are divided into several general categories: (1) social-demographic characteristics, (2) information exposure, (3) visitor perception of a human impact problem in the Paradise Meadows area, (4) attitude toward the impact of personal off-trail hiking behavior, and (5) motivation to comply with National Park Service behavioral expectations in the Paradise area (ascription to agency norms).

Bivariate statistical tests were performed with all independent (predictor) variables used in the analysis under null hypotheses predicting no differences between the subsamples of compliers (hikers who remained on the trail) and noncompliers (hikers who departed from the formal trail). Following the bivariate tests, all variables for which the null hypotheses were rejected (i.e., which were significantly related to off-trail hiking behavior) were combined in a discriminate analysis to determine the ability of the combination of predictor variables to distinguish between the complier and noncomplier subsamples.

To perform statistically valid comparisons between off-trail hikers and other visitors, it is necessary that the two subsamples be selected in a manner so that observed differences between the two groups can be inferred to be associated with off-trail hiking status. This criterion is satisfied by drawing matched subsamples of off-trail hikers and all other visitors at the observation sites. Because only the samples at the Lower

Meadow and the Dead Horse sign experimental sites strictly satisfy these sampling requirements, these data alone are used in the off-trail hiker profile.

The proportion of compliers (58 percent) and noncompliers (42 percent) in the survey sample do not indicate the true proportion of these groups at the observation sites. The 58 and 42 percent proportions are a result of the research design in which every noncomplier was sampled, and every nth complier was also selected at the experimental sites.

SOCIAL DEMOGRAPHIC CHARACTERISTICS

Table 1 presents socio-demographic variables used in the analysis. When a variable is marked by an asterisk, this indicates that the null hypothesis was rejected at the .05 level of significance. If the null hypothesis was not rejected, it was assumed that there is no difference between the two subsamples (complier, noncomplier) on the basis of the variable under consideration.

Table 1. Social Demographic Characteristics Used to Profile Noncompliers to Trailside Signs - 1987 Paradise Meadows Visitor Survey

Individual Characteristics	
1. Age	
2. Gender	
* 3. Education	
4. Occupation	
* 5. Place of Residence	
Group or Party Characteristics	
* 1 Group Size	
2. Group Makeup	
Trip Characteristics	
1. First or Repeat Trip	
2. Past Visitation Frequency	
3. Entry Location	

* Indicates a significant statistical difference between compliers and noncompliers at the .05 level of significance

Individual Characteristics

Although the null hypotheses for four socio-demographic variables were rejected, the measures of strength of association for these variables are weak. The average number of years of formal education for the complying subsample was 16.1; the average number of years of formal education for the noncomplying subsample was 15.6 (Table 2). Sixteen percent of the compliers had 12 or less years of education compared to 22 percent of the noncompliers. Forty-two percent of the compliers had 17 or more

years of formal education compared to 34 percent of the noncompliers.

Local (King, Pierce, Lewis, Yakima counties) visitors comprised 34 percent of the complier sample compared to 44 percent of the noncomplier sample (Table 3). Sixty-seven percent of the compliers were out-of-state visitors compared to 33 percent of the noncompliers.

There were no significant differences in the noncompliant and compliant subsamples based on age, gender and occupation. While age differences were not significant, the survey sample includes only those persons aged 16 years and over. Hence, there does not appear to be incompatibility between these data and the experimental data collected at these sites which indicated higher noncompliance rates among teenagers and younger children (Swearingen and Johnson, 1988).

Table 2. Level of Education by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-33. What is the highest year of formal education you have completed?

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
YEARS OF EDUCATION:			
1-12 Years	50% 16% 64	50% 22% 63	100% 18% 127
13-16 Years	56% 42% 164	44% 45% 131	100% 43% 295
17 or More Years	63% 42% 167	37% 34% 98	100% 39% 265
Column Totals	57% 100% 395	43% 100% 292	100% 100% 687

Missing Cases = 0
Chi-Square = 6.36 p = .0415

1 C = Complier NC = Noncomplier

Table 3. Permanent Residence by Compliance Status - 1987 Paradise Meadows Visitor Survey

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
RESIDENCE:			
Local[2]	51% 34% 133	49% 44% 127	100% 38% 260
Non-Local Washington	54% 17% 67	46% 19% 56	100% 18% 123
Out-of-State	67% 47% 184	33% 32% 92	100% 40% 276
Foreign Country	42% 3% 11	58% 5% 15	100% 4% 26
Column Totals	58% 100% 395	42% 100% 290	100% 100% 685

Missing Cases = 2
Chi-Square = 16.7 p = .0008

1 C = Complier NC = Noncomplier

2 "Local" status describes those individuals who reside in the four-county area surrounding the Park: King, Lewis, Pierce, and Yakima.

NOTE: The above information was obtained from responses provided on the on-site form.

Party Characteristics

Persons from large parties are disproportionately represented in the noncomplying sample (Table 4). The average group size for compliers was 3.5 compared to 4.5 for noncompliers. The frequency of noncompliance was highest for groups over 8 and lowest for single individuals. There was no difference between the complying and noncomplying subsamples on the basis of group makeup, (i.e., individual, family, friends, a combination of both, or an organized group). However, there were few organized tour group members in the samples, so conclusions can not be drawn about this group.

Visitation Frequency

There was no difference in visitation frequency (including first time visitation) between the complying and noncomplying subsamples.

Table 4. Group Size by Compliance Status - 1987 Paradise Meadows Visitor Survey

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
GROUP SIZE:			
1	64% 6% 25	36% 5% 14	100% 6% 39
2	62% 43% 171	38% 35% 103	100% 40% 274
3	60% 17% 68	40% 16% 46	100% 17% 114
4	55% 17% 67	45% 19% 55	100% 18% 122
5-8	52% 13% 50	48% 16% 46	100% 14% 96
9+	33% 4% 14	67% 10% 28	100% 6% 42
Column Totals	57% 100% 395	43% 100% 292	100% 100% 687

Missing Cases = 0
Chi-Square = 15.14 p = .0098

1 C = Complier NC = Noncomplier

NOTE: The above information was obtained from responses provided on the on-site form

INFORMATION EXPOSURE VARIABLES

Information exposure variables are categorized into four groups: (1) exposure to within park information media and sources, (2) exposure to minimum impact guidelines and visitor impact on the environment from Mount Rainier National Park or elsewhere, (3) exposure to visitor information facilities within the Park, and (4) understanding of Park Service minimum impact behavioral expectations for the Paradise Meadows.

Within Park Information Media and Sources

Survey respondents were asked if they had been exposed to several information sources in Mount Rainier National Park during the trip on which they were contacted (Table 6). The null hypotheses of no difference in exposure frequencies between the compliant and noncompliant subsamples were rejected for these information sources: indoor exhibits, naturalist's talks, personal contact with park staff at the information desk, other personal contact with the park staff, park brochures or pamphlets, written trailhead signs, and frontcountry trailside signs (Tables 6-12). The variable naturalist walks was close to the .05 level of significance (.066).

Because virtually all subjects should have been exposed to frontcountry trailside signs (visitors were contacted near a trailside sign), the visitor responses to this variable are suspect and should be interpreted with caution. Consequently, this variable was eliminated from the subsequent discriminate analysis.

The statistical associations of information exposure variables to compliance (visitor behavior) are weak. The variable with the strongest association is exposure to trailhead signs (r=.164) followed by frontcountry signs (r=.155). The weakest associations were with indoor signs or posters (r=.074) and naturalist's talks (r=.079).

Table 5. Information Media or Sources Used to Profile Noncompliers to Trailside Signs - 1987 Paradise Meadows Visitor Survey

*	1. Indoor signs or posters
*	2. Indoor exhibits
*	3. Naturalists talks
	4. Naturalists walks
*	5. Personal contact with park staff at information desk
*	6. Other personal contact with park staff
*	7. Park brochures or pamphlets
	8. Audio trailhead signs
*	9. Written trailhead signs
	10. Backcountry signs
	11. Roadway signs
	12. Park litter bag

* Indicates significant statistical difference between compliers and noncompliers on the basis of this variable at the .05 level of significance.

Table 6. Exposure to Indoor Signs or Posters by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-5. During the trip to Mt. Rainier on which you were contacted, to which of the following educational or interpretive information sources were you exposed?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1]		Row Totals
	C	NC	
INDOOR SIGNS OR POSTERS:			
Not Exposed	53% 38% 152	47% 46% 134	100% 42% 286
Exposed	61% 62% 243	39% 54% 158	100% 58% 401
Column Totals	57% 100% 395	43% 100% 292	100% 100% 687

Missing Cases = 0
Chi-Square = 3.79 p = .0515

1 C = Complier NC = Noncomplier

Table 7. Exposure to Indoor Exhibits by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-5. During the trip to Mt. Rainier on which you were contacted, to which of the following educational or interpretive information sources were you exposed?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
INDOOR EXHIBITS:			
Not Exposed	52% 36% 143	48% 45% 132	100% 40% 275
Exposed	61% 64% 252	39% 55% 160	100% 60% 412
Column Totals	57% 100% 395	43% 100% 292	100% 100% 687

Missing Cases = 0
Chi-Square = 5.67 p = .0173

1 C = Complier NC = Noncomplier

Table 8. Exposure to Naturalists' Talks by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-5. During the trip to Mt. Rainier on which you were contacted, to which of the following educational or interpretive information sources were you exposed?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1] C	NC	Row Totals
NATURALISTS' TALKS:			
Not Exposed	56% 81% 320	44% 87% 254	100% 84% 574
Exposed	66% 19% 75	34% 13% 38	100% 16% 113
Column Totals	57% 100% 395	43% 100% 292	100% 100% 687

Missing Cases = 0
Chi-Square = 4.36 p = .0368

1 C = Complier NC = Noncomplier

Table 9. Exposure to Park Staff at Information Desk by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-5. During the trip to Mt. Rainier on which you were contacted, to which of the following educational or interpretive information sources were you exposed?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
PERSONAL CONTACT WITH PARK STAFF AT INFORMATION DESK:			
Not Exposed	53% 53% 210	47% 63% 185	100% 57% 395
Exposed	63% 47% 185	37% 37% 107	100% 43% 292
Column Totals	57% 100% 395	43% 100% 292	100% 100% 687

Missing Cases = 0
Chi-Square = 7.14 p = .0076

1 C = Complier NC = Noncomplier

Table 10. Exposure to Park Staff Other Than at Information Desk by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-5. During the trip to Mt. Rainier on which you were contacted, to which of the following educational or interpretive information sources were you exposed?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
ANY OTHER PERSONAL CONTACT WITH PARK STAFF:			
Not Exposed	54% 59% 235	46% 70% 203	100% 64% 438
Exposed	64% 41% 160	36% 30% 89	100% 36% 249
Column Totals	57% 100% 395	43% 100% 292	100% 100% 687

Missing Cases = 0
Chi-Square = 7.30 p = .0069

1 C = Complier NC = Noncomplier

Table 11. Exposure to Park Brochures or Pamphlets by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-5. During the trip to Mt. Rainier on which you were contacted, to which of the following educational or interpretive information sources were you exposed?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
PARK BROCHURES OR PAMPHLETS:			
Not Exposed	51% 27% 108	49% 35% 102	100% 31% 210
Exposed	60% 73% 287	40% 65% 190	100% 69% 477
Column Totals	57% 100% 395	43% 100% 292	100% 100% 687

Missing Cases = 0
Chi-Square = 4.56 p = .0328

1 C = Complier NC = Noncomplier

Table 12. Exposure to Written Trailhead Signs by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-5. During the trip to Mt. Rainier on which you were contacted, to which of the following educational or interpretive information sources were you exposed?

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
WRITTEN TRAILHEAD SIGNS:			
Not Exposed	42% 15% 60	58% 29% 84	100% 21% 144
Exposed	62% 85% 335	38% 71% 208	100% 79% 543
Column Totals	57% 100% 395	43% 100% 292	100% 100% 687

Missing Cases = 0
Chi-Square = 18.68 p = .0000

1 C = Complier NC = Noncomplier

Visitation of Mount Rainier Information Centers

There were no differences between the compliant and noncompliant subsamples in the frequency of visitation to Longmire Information Center, Paradise Visitor Center, or the Paradise Ranger Station (Table 13). Significant differences between the two subsamples were found in frequencies of visitation to Longmire Historical Museum, Sunrise Visitors Center, and Ohanapecosh Visitor Center. (Tables 14, 15, 16) The statistical associations are weak (r = .080, .080, and .092, respectively). There is no difference between the compliant and noncompliant samples on the basis of visiting or not visiting any information center on the current trip.

Repeat visitors were also asked if they had previously visited any of the listed information centers. Although the associations were weak, a higher proportion of compliers had previously stopped at either the Ohanapecosh Visitor Center or the Sunrise Visitor Center (Table 17, 18).

Table 13. Visitation at Mount Rainier Information Centers Used to Profile Noncompliers to Trailside Signs - 1987 Paradise Meadows Visitor Survey

Stopped on the trip contacted	
1.	Longmire Information Center
* 2.	Longmire Historical Museum
3.	Paradise Visitor Center
4.	Paradise Climbers' Registration Hut
* 5.	Sunrise Visitors' Center
* 6.	Ohanapecosh Visitors' Center
7.	Stopped at any center
Stopped on any previous trip	
1.	Longmire Information Center
2.	Longmire Historical Museum
3.	Paradise Visitor Center
4.	Paradise Climbers' Registration Hut
* 5.	Sunrise Visitors' Center
* 6.	Ohanapecosh Visitor's Center

* Indicates significant statistical differences between compliers and noncompliers on the basis of this variable at the .05 level of significance.

Table 14. Visit to Longmire Historical Museum by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-4. Did you visit any of the following information or visitors' centers at Mt. Rainier National Park during the trip on which you were contacted?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1] C	NC	Row Totals
LONGMIRE INFORMATION CENTER:			
Did Not Visit	59% 88% 342	41% 82% 235	100%
Did Visit	48% 12% 45	52% 17% 49	100%
Column Totals	58% 100% 387	42% 100% 284	100% 100% 671

Missing Cases = 0
Chi-Square = 4.3 p = .0380

1 C = Complier NC = Noncomplier

Table 15 Visit to Sunrise Visitor Center by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-4. Did you visit any of the following information or visitors' centers at Mt. Rainier National Park during the trip on which you were contacted?

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
SUNRISE VISITOR CENTER:			
Did Not Visit	56% 84% 326	44% 90% 255	100% 87% 581
Did Visit	68% 16% 61	32% 10% 29	100% 13% 90
Column Totals	58% 100% 387	42% 100% 284	100% 100% 671

Missing Cases = 0
Chi-Square = 4.35 p = .0371

1 C = Complier NC = Noncomplier

Table 16. Visit to Ohanapecosh Visitor Center by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-4. Did you visit any of the following information or visitors' centers at Mt. Rainier National Park during the trip on which you were contacted?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
OHANAPECOSH VISITOR CENTER:			
Did Not Visit	57% 93% 360	43% 97% 276	100% 95% 636
Did Visit	77% 7% 27	23% 3% 8	100% 5% 35
Column Totals	58% 100% 387	42% 100% 284	100% 100% 671

Missing Cases = 0
Chi-Square = 5.73 p = .0166

1 C = Complier NC = Noncomplier

Table 17. Previous visit to Sunrise Visitor Center by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-3. On any previous trip to Mt. Rainier National Park, other than the trip on which you were contacted, did you visit any of the following information or visitors' centers?

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
SUNRISE VISITOR CENTER:			
Did Not Previously Visit	53% 57% 138	47% 69% 121	100% 62% 259
Did Previously Visit	65% 43% 104	35% 31% 55	100% 38% 159
Column Totals	58% 100% 242	42% 100% 176	100% 100% 418

Missing Cases = 0
Chi-Square = 5.94 p = .0148

1 C = Complier NC = Noncomplier

NOTE: Only those who indicated they had previously visited the Park completed this question.

Table 18. Previous visit to Ohanapecosh Visitor Center by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-3. On any previous trip to Mt. Rainier National Park, other than the trip on which you were contacted, did you visit any of the following information or visitors' centers?

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
OHANAPECOSH VISITOR CENTER:			
Did Not Previously Visit	55% 77% 186	45% 87% 153	100% 81% 339
Did Previously Visit	71% 23% 56	29% 13% 23	100% 19% 79
Column Totals	58% 100% 242	42% 100% 176	100% 100% 418

Missing Cases = 0
Chi-Square = 6.74 p = .0094

1 C = Complier NC = Noncomplier

NOTE: Only those who indicated they had previously visited the Park completed this question.

Exposure to Minimum Impact Guidelines or Information Relating to Visitor Impact on the Environment

Question 6 in the questionnaire asked participants if they had been exposed to Park Service minimum impact information or information relating to visitor impact upon the environment on the trip during which they were contacted.

Q-6 During the trip to Mt. Rainier on which you were contacted, were you exposed to Park Service information sources relating to visitor impact on the natural environment or minimum impact use guidelines? (Circle one number)

1. NO. I WAS NOT EXPOSED TO EITHER INFORMATION RELATED TO VISITOR IMPACT OR MINIMUM IMPACT GUIDELINES.

2. YES. I WAS EXPOSED TO INFORMATION RELATING TO IMPACT UPON THE NATURAL ENVIRONMENT ONLY.

3. YES. I WAS EXPOSED TO MINIMUM IMPACT USE GUIDELINES ONLY.

4. YES. I WAS EXPOSED TO BOTH MINIMUM IMPACT GUIDELINES AND INFORMATION ON VISITOR IMPACT.

5. I DON'T KNOW OR DON'T REMEMBER.

Almost no one indicated (3) "Yes, I was exposed to minimum impact guidelines only." Therefore, the response categories were collapsed to: (1) not exposed, (2) exposed to either or both minimum impact guidelines and visitor impact information and (3) don't know or don't remember.

Question 7 asked respondents if they had been exposed to minimum impact guidelines or information relating to visitor impact from any other source.

Q-7 From sources other than Mt. Rainier National Park, have you ever been exposed to information relating to visitor impact on any natural environment or minimum impact use guidelines for environmentally sensitive areas? (Circle one number)

1. NO

2. YES

The null hypotheses were rejected for both variables, but the resulting statistical relationships are weak (Table 19 and 20). For question six, there was a somewhat higher proportion of people in the noncomplier sample who indicated they did not know or did not remember if they had been exposed to such information on the trip on which they were contacted. For question 7, there was also a somewhat higher proportion of noncompliant respondents who had not been exposed to information relating to visitor impact from sources other than MORA.

In the entire sample, 10 percent (71 persons), said they had never been exposed to minimum impact information or information relating to visitor impact from any source. The proportion of these individuals was not significantly different in the complier and noncomplier subsamples. This finding appears incongruent with the previous two reported associations, and is probably the result of the weak relationships between exposure to information and off-trail hiking behavior.

Table 19. Exposure to Information Sources Relating to Visitor Impact or Minimum Impact Use Guidelines by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-6. During the trip to Mt. Rainier on which you were contacted, were you exposed to Park Service information sources relating to visitor impact on the natural environment or minimum impact use guidelines?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
EXPOSED TO SOURCES:			
No	57% 18% 71	43% 18% 53	100% 18% 124
Exposed to Information, Guidelines, or Both	62% 68% 265	38% 56% 164	100% 63% 429
Don't Know or Remember	42% 14% 54	58% 25% 74	100% 19% 128
Column Totals	57% 100% 390	43% 100% 291	100% 100% 681

Missing Cases = 6
Chi-Square = 15.45 p = .000

1 C = Complier NC = Noncomplier

Table 20 Exposure to Other Information Sources Relating to Visitor Impact or Minimum Impact Use Guidelines by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-7. From sources other than Mt. Rainier National Park, have you ever been exposed to information relating to visitor impact on any natural environment or minimum impact use guidelines for environmentally sensitive areas?

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS1		Row Totals
	C	NC	
EXPOSED TO SOURCES:			
No	48% 27% 107	52% 40% 116	100% 33% 223
Yes	62% 73% 283	38% 60% 174	100% 67% 457
Column Totals	57% 100% 390	43% 100% 290	100% 100% 680

Missing Cases = 7
Chi-Square = 11.91 p = .0006

1 C = Complier NC = Noncomplier

Understanding of Park Service Behavioral Expectations

There was no difference in the proportion of compliers and noncompliers who said they understood Park Service general expectations for low impact visitor behavior in environmentally sensitive areas (Q-25). There was also no difference in the proportion of compliers and noncompliers who said they understood Park Service expectations for low impact behavior in the Paradise Meadows (Q-26). About 12 percent of the combined sample indicated they did not understand Park Service expectations for behavior in the Paradise Meadows areas.

PERCEPTION OF HUMAN IMPACT PROBLEM

Question 22 asked for respondents' perceptions of the degree of human impact on the natural environment.

Q-22 In your opinion, is there currently a problem with human impact on the natural environment in the Paradise Meadows area? (Circle one number)

1. THERE IS A SUBSTANTIAL PROBLEM.
2. THERE IS A MODERATE PROBLEM.
3. THERE IS A SLIGHT PROBLEM.
4. THERE IS A PROBLEM
5. I DON'T KNOW OR HAVE NO OPINION.

The first questionnaires administered had a typographical error (n=213) with the word "substantial" omitted from the first response category. Due to this omission, the two versions were analyzed separately (Tables 21, 22). In both instances, the null hypotheses were rejected. Although the associations remain weak, they are among the strongest reported in the complier/noncomplier profile (Cramer's V=.190 and .223 respectively). Twenty-five percent of the complier subsample felt there was a substantial human impact problem in the Paradise Meadow, compared to 15 percent of the noncomplier subsample. Twelve percent of the noncompliers felt there was no problem with human impact in the meadow, compared to 6 percent of the compliers. Following a comparative analysis of responses between the two versions of the questionnaires, respondents who indicated: 1. "There is a problem" in the typographical error version of the questionnaire

were recoded to be identical to respondents saying "There is a substantial problem" in the corrected version of the questionnaire for inclusion in the discriminate analysis

Table 21. Perception of Human Impact Problem in Paradise Meadows Area (early version) by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-22. In your opinion, is there currently a problem with human impact on the natural environment in the Paradise Meadows area?

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
DEGREE OF PROBLEM:			
There is a Problem (typo error version)	68% 34% 43	32% 23% 20	100% 30% 63
Moderate Problem	67% 33% 41	33% 23% 20	100% 29% 61
Slight Problem	50% 18% 22	50% 25% 22	100% 21% 44
No Problem	44% 6% 7	56% 10% 9	100% 8% 16
Don't Know/No Opinion	41% 10% 12	59% 19% 17	100% 14% 29
Column Totals	59% 100% 125	41% 100% 88	100% 100% 213

Missing Cases = 0
Chi-Square = 10.63 p = .0310

1 C = Complier NC = Noncomplier

Table 22. Perception of Human Impact Problem in Paradise Meadows Area (corrected version) by Compliance Status - 1987 Paradise Meadows Visitor Survey

Q-22. In your opinion, is there currently a problem with human impact on the natural environment in the Paradise Meadows area?

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
DEGREE OF PROBLEM:			
Substantial Problem	68% 25% 65	32% 15% 30	100% 21% 95
Moderate Problem	62% 38% 101	38% 31% 62	100% 35% 163
Slight Problem	54% 19% 51	46% 22% 43	100% 20% 94
No Problem	40% 6% 17	60% 13% 25	100% 9% 42
Don't Know/No Opinion	43% 11% 30	57% 20% 39	100% 15% 69
Column Totals	57% 100% 264	43% 100% 199	100% 100% 463

Missing Cases = 11
Chi-Square = 16.81 p = .0021

1 C = Complier NC = Noncomplier

ATTITUDE TOWARD OFF-TRAIL HIKING AND ASCRIPTION TO AGENCY NORMS

Fishbein and Ajzen (1975, 1980) have advanced a theory of reasoned action to explain and predict behavior. Fishbein and Ajzen hold that most behavior is subject to cognitive reflection, is under volitional control, and is consistent with intentions to perform or not perform certain acts. Intentions to behave in a certain way are the result of two types of causes: (1) personal and (2) social (Ajzen and Fishbein, 1980.)

> The personal factor is the individual's positive or negative evaluation of performing the behavior; this factor is termed attitude toward behavior. It simply refers to the person's judgment that performing the behavior is good or bad, that he is in favor of or against performing the behavior. The second determinant of intention is the person's perception of the social pressures put on him to perform or not to perform the behavior in question. Since it deals with perceived prescription this factor is named subjective norm. (ibid, p.6)

The relative importance of these two areas for the individual depends on the nature of the behavior and the individual intentions. For any individual, behavior can be seen as following from the factors below.

For a more complete understanding of behavior, however, it is necessary to understand what determines attitudes and subjective norms (Ajzen and Fishbein, 1980).

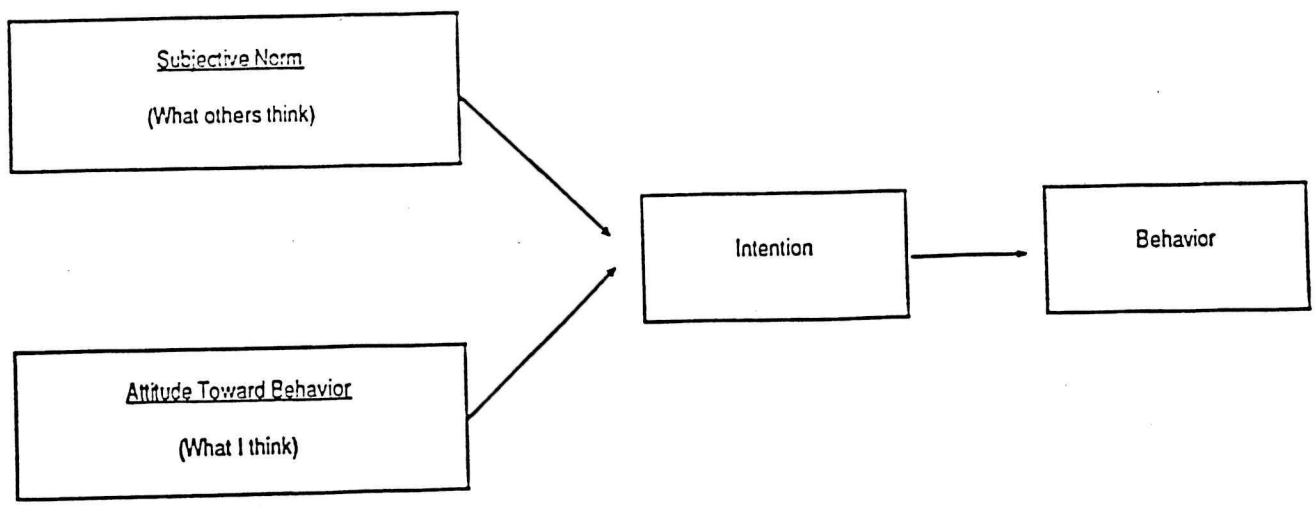

Figure 1. Norms, Attitudes, Intensions and Behavior
Source: Ajzen and Fishbein, *Understanding Attitudes and Predicting Social Behavior.* 1980.

According to the theory, attitudes are a function of beliefs. Generally speaking, a person who believes that performing a given behavior will lead to mostly positive outcomes will hold a favorable attitude toward performing the behavior, while a person who believes that performing the behavior will lead to mostly negative outcomes will hold an unfavorable attitude. The beliefs that underlie a person's attitude toward the behavior are termed behavioral beliefs. To illustrate, consider a man that believes that buying a video game would make his children happy, would permit his family to spend time together, and would provide interesting diversion at social gatherings with friends. A person holding such behavioral beliefs is likely to evaluate positively the act of buying a video game. In contrast, an individual is likely hold an unfavorable attitude toward this behavior if he believes that buying a video game would provide only temporary amusement for his children, would add to the growing number of unused gadgets collecting dust in the attic, would be quite expensive, and would divert funds that could otherwise be invested in educational games.

Subjective norms are also a function of beliefs, but beliefs of a different kind, namely the person's beliefs that specific individuals or groups think he should or should not perform the behavior. These beliefs underlying a person's subjective norm are termed normative beliefs. Generally speaking, a person who believes that most referents with whom he is motivated to comply think he should perform the behavior will perceive social pressure to do so. Conversely, a person who believes that most referents with whom he is motivated to comply think he should not perform the behavior will have a subjective norm that puts pressure on him to avoid performing the behavior. For example, suppose that in the area of buying household products a woman is motivated to comply with what she perceives to be the wishes of her husband, her children, her mother, and her close friends. If she believes that these referents think she should buy a video game, her subjective norm will exert pressure to perform this behavior. On the other hand, a woman who believes that her husband, children, mother, and close friends all think she should not buy a video game will perceive social pressure in the opposite direction. Thus, the subjective norm may exert pressure to perform or not perform a given behavior, independent of the person's own attitude toward the behavior in question. (ibid, p.7).

The entire Ajzen and Fishbein model is displayed in Figure 2.

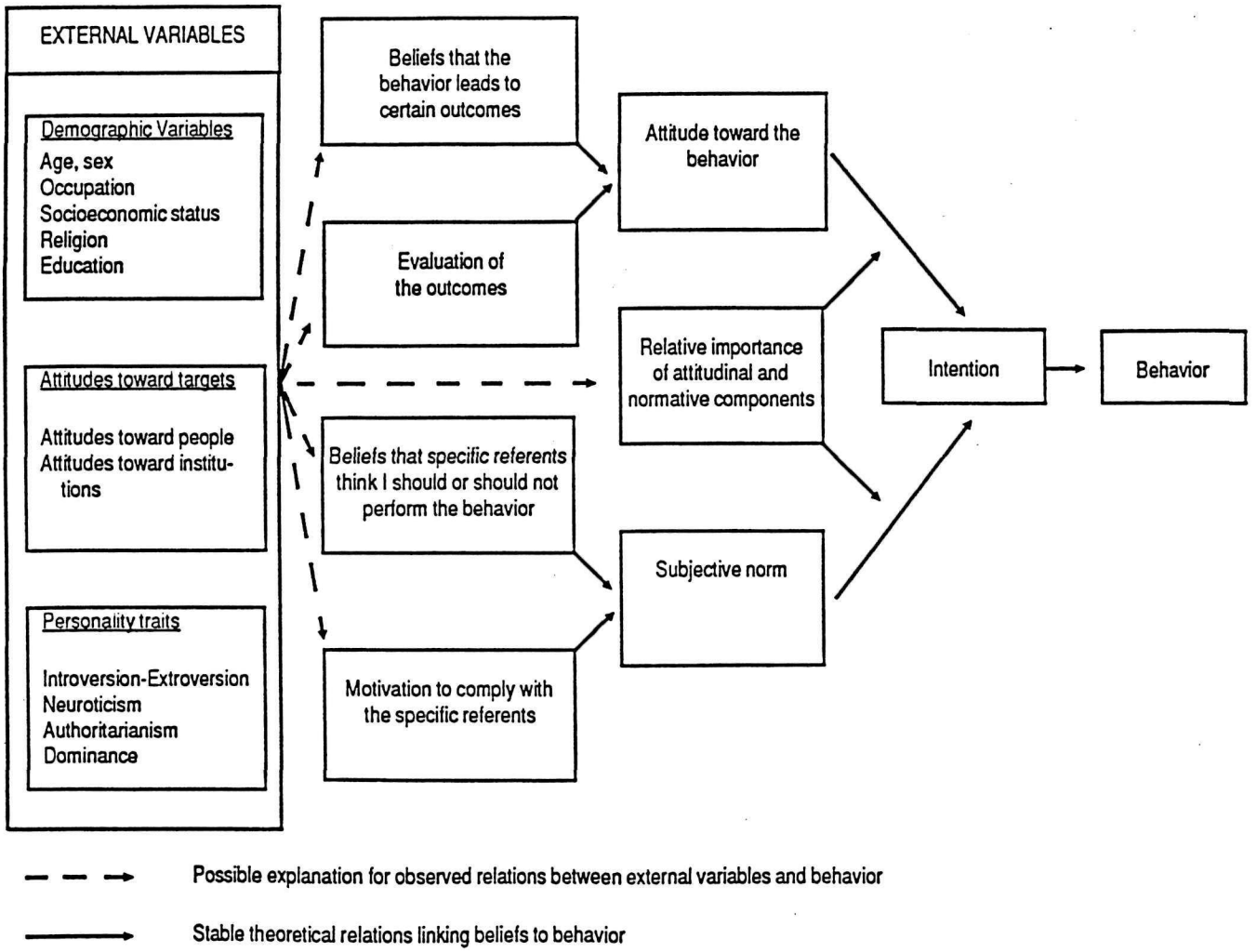

Figure 2. Model of reasoned action.
Source: Ajzen and Fishbein, *Understanding Attitudes and Predicting Social Behavior.* 1980.

Questions 9 thru 21 in the questionnaire (Appendix C) were constructed after the Fishbein-Ajzen model. Subjective norms derived from friends, family, etc. were not included in the questionnaire. Statements measuring such norms (e.g., "Members of my family want me to stay on the trail"; "My friends want me to stay on the trail") were considered trite and were poorly received by some respondents. Further, the opinions of family and friends of visitors are not under the control of the agency. Therefore, they are not of primary concern in applied research efforts.

Question 20 was constructed to measure ascription to agency norms. Question 21 was constructed to measure motivation to comply to agency norms. Questions 9 and 10 were intended to measure intentions to walk off designated trails in the future. Questions 11 thru 15 were designed to measure attitudes toward off-trail hiking behavior. Questions 16 and 17 were created to measure outcome evaluations of off-trial hiking behavior. Question 19 was intended to measure behavioral beliefs.

Using a statistical technique called factor analysis, it was determined that these items measured three underlying factors or dimensions (Figure 3). These were: (1) behavioral intentions (Q-9 and 10), (2) attitudes toward harmfulness of personal off-trail hiking behavior (Q-11 thru Q-15) and (3) a third factor combining the normative belief items and the motivation to comply item (Q-20, 21). The other items (Q-16, Q-19 and Q-17) did not factor as separate dimensions and were dropped from the analysis.

Items 16 and 19 were intended to measure outcome evaluations, but the factor analysis indicated they were measuring the same underlying dimension as the normative items (Q-20 and Q-21). There did not appear to be an intuitive conceptualization of an underlying dimension represented by the four items. Thus, the decision was made to retain the normative items which had higher factor scores. The two items will herein be conceived as measuring motivation to comply to Park Service behavioral expectations.

Of the retained items described above, the attitude toward behavior items (Q-11 thru Q-15) were summed and the motivation to comply items (Q-20 thru Q-21) were multiplied. This procedure results in multi-item measures of single underlying concepts which have more desirable statistical properties than single item measures.

The bivariate correlation coefficient between compliant/ noncompliant behavior and attitude toward the harmfulness of off-trail hiking is .231. This is a weak association, but it is the strongest obtained in the analysis of the compliant/noncompliant subsamples. The bivariate correlation of motivation to comply to Park Service norms (behavioral expectations) with visitor behavior (compliance) is .119.

Behavior Intentions

Q-9 When dayhiking in a natural park or natural area in the future, I will walk off the designated trails whenever I desire.

Q-10 When dayhiking in a natural park or natural area in the future, I will occasionally walk off the designated trails.

Attitude Toward Personal Off-Trail Hiking Behavior

Q-11 Hiking off designated trails onto a convenient shortcut at Paradise Meadows is:

Q-12 Hiking off designated trails onto the meadow for a picnic at Paradise Meadows is:

Q-13 Hiking off designated trails onto the meadow to see a scenic vista at Paradise Meadows is:

Q-14 Hiking off designated trails onto the meadow for a photo opportunity at Paradise Meadows is:

Q-15 Hiking off designated trails on the meadow to reach a rest area or shade at Paradise Meadows is:

Motivation to Comply to NPS Rules

Q-20 In the Paradise Meadows area at Mt. Rainier National Park, the Park Service's expectations for me to hike on designated trails is important to me.

Q-21 Generally speaking, I will comply with National Park Service rules when dayhiking at Paradise Meadows.

FIGURE 3

Items Used to Measure Attitude Toward Off-Trail Hiking, Behavioral Intentions Regarding Off-Trail Hiking and Motivation To Comply to NPS Rules.

Table 23. Behavioral Attitude by Compliance Status - 1987 Paradise Meadows Visitor Survey.

Cells: Row Percent Col Percent Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
ATTITUDE TOWARD BEHAVIOR:[2]			
Low Score	45% 26% 96	55% 43% 119	100% 33% 215
Middle Score	63% 36% 135	37% 28% 79	100% 33% 214
High Score	64% 38% 143	36% 29% 80	100% 34% 223
Column Totals	57% 100% 374	43% 100% 278	100% 100% 652

Missing Cases = 35
Chi-Square = 21.24 p = .0000

1 C = Complier NC = Noncomplier

2 The items used to create this scale were Q-11 to Q-15.

Table 24. Normative Beliefs by Compliance Status - 1987 Paradise Meadows Visitor Survey.

Cells: Row Percent / Col Percent / Count	COMPLIANCE STATUS[1] C	COMPLIANCE STATUS[1] NC	Row Totals
NORMATIVE BELIEFS:[2]			
Low Score	49% 27% 105	51% 38% 108	100% 32% 213
Middle Score	58% 19% 75	42% 19% 54	100% 19% 129
High Score	63% 53% 205	37% 43% 121	100% 49% 326
Column Totals	58% 100% 385	42% 100% 283	100% 100% 668

Missing Cases = 19
Chi-Square = 9.76 p = .0076

1 C = Complier NC = Noncomplier

2 The items used to create this scale were Q-20 and Q-21.

DISCRIMINATE ANALYSIS

The preceding analysis identified 18 variables that were statistically associated with visitor behavior at the sign experimental sites (Table 25). In addition to off-trail hiking, many of these variables may also be correlated with each other. Thus, it is desirable to identify those variables whose statistical association with off-trail hiking is present because of this mutual association. The result of such an analysis is the most parsimonious explanation of the variables that predict the outcome of the dependent variable (i.e., compliance or noncompliance to trailside signs).

Discriminate analysis allows the researcher to identify differences between two groups with several variables considered simultaneously. The predictor variables are those identified in the bivariate statistical analyses as being significantly associated with off-trail hiking. These variables will be called discriminating variables. Although the mathematical procedures involved are complex, discriminate analysis lends itself to classification procedures which are very intuitive.

In this study, the results can be interpreted to indicate: (1) the set of variables included in the present analysis that best predicts whether individuals will be compliers or noncompliers; and (2) the proportion of cases that can be successfully classified as compliers or noncompliers given the observed statistical associations. For readers familiar with regression analysis, two group discriminate analysis is closely related to multiple linear regression, where the two group

variable is considered the dependent variable, and the predictor variables are the independent variables.

Although some of the variables used in the analysis are theoretically derived, the purpose of the present analysis is not to test a theory of behavior. The goal of the discriminate analysis is simply to identify the set of variables available in the survey that best predicts visitor behavior.

A requirement of discriminate analysis is that the group variables be dichotomies (e.g., compliance/noncompliance) and the predictor variables be continuous (e.g., years of education). Therefore, the variables associated with compliance that are not continuous must be transformed to meet this criterion. This change can be accomplished by converting variables such as place of residence (categories) to "dummy variables". Dummy variables are simple yes/no expressions of each of the categories and are continuous (ranging from zero to one). In the case of residence location, for example, there are four dummy variables. The resulting values each qualify as continuous measures and are satisfactory for the discriminate analysis. Entry location, place of residence, and Q-6 (exposure to minimum impact questions) were converted to dummy variables.

Table 26 lists the variables entering the discriminate function. Using values from 10 variables, 65.4 percent of the cases were classified correctly as compliers or noncompliers. Most of the ability of the discriminate function (i.e., the equation constructed by the discriminate analysis) to classify cases was provided by the variables: (1) attitudes toward the

harmfulness of personal off-trail hiking behavior, (2) out-of-state resident status, (3) the degree of human impact perceived in the meadow, and (4) exposure to written trailhead signs. The rest of the variables, while representing statistically significant contributions to the analysis, together provide only a small part of the predictive ability of the function (Table 26). Using the top four variables only, the function is able to classify 63.7 percent of the cases correctly (Table 26). When the ten significant variables are taken into account first, the other variables that did not enter the discriminate function statistically contribute nothing to the prediction of compliance and noncompliance.

These findings do not mean, however, that the bivariate associations are inaccurate. For example, although exposure to park brochures did not enter the discriminate function, the fact remains that those who were exposed to brochures were more likely to be in the compliant group. Because exposure to park brochures was also related to other variables which were more strongly related to compliant behavior, it is assumed that these variables account for the compliant behavior, and exposure to brochures is removed from the function.

Table 25. Summary of Bivariate Statistical Findings - 1987 Paradise Meadows Visitor Survey

VARIABLES ASSOCIATED WITH COMPLIANCE/NONCOMPLIANCE	VARIABLES NOT ASSOCIATED WITH COMPLIANCE/NONCOMPLIANCE
SOCIAL DEMOGRAPHIC CHARACTERISTICS	
Individual Characteristics	*Individual Characteristics*
1. Education	1. Age
2. Place of residence	2. Gender
	3. Occupation
Party Characteristics	*Party Characteristics*
1. Group size	1. Group makeup (e.g., family, friends, etc.)
	Trip Characteristics
	1. First or repeat trip
	2. Past visitation frequency
	3. Entry Location
INFORMATION EXPOSURE VARIABLES	
Within Park Information Media	*Within Park Information Media*
1. Indoor signs and brochures	1. Naturalist walks
2. Indoor exhibits	2. Audio trailhead sign
3. Naturalist talks	3. Backcountry signs
4. Personal contact with park staff at information desk	4. Roadway signs
5. Other personal contact with park staff	5. Park litter bag
6. Written trailhead signs	
Directly Related Park Information/ Current Trip	
1. Visitor Impact on environment	
2. Minimum Impact guidelines	
Visitation at Mt. Rainier Information Centers on Trip Contacted	*Visitation at Mt Rainier Centers on Trip Contacted*
1. Longmire Historical Museum	1. Longmire Information Center
2. Sunrise Visitors' Center	2. Paradise Visitor Center
3. Ohanapecosh Visitors' Center	3. Paradise Climbers' Hut
SOCIAL PSYCHOLOGICAL VARIABLES	
1. Perception of the degree of human impact, Paradise Meadows	1. Understanding of Park Service Behavioral Expectations
2. Attitude toward harmfulness of off-trail hiking	
3. Ascription to agency norms	

Table 26. Variables and Order of Their Importance to Predict Compliance and Noncompliance, All Variables[1] - 1987 Paradise Meadows Visitor Survey

Variable Name	Residual Variance
1. Attitude toward harmfulness of personal off-trail hiking	.948
2. Out-of-state residence	.927
3. Perception of degree of human impact in the meadow.	.910
4. Exposure to written trailhead sign	.901
5. Exposure to Mt. Rainier information on human impact or minimum impact guidelines on present trip	.897
6. Years of formal education	.893
7. Group size	.891
8. Exposure to Naturalists' talks	.889

[1] Procedure run by SPSS with stepwise variable selection. Selection rule was "minimize sum of unexplained variance". List wise deletion of cases for missing values resulted in 619 used in the analysis. Prior sizes between subsamples is assumed to be known.

DISCUSSION

The results of this study do not mean that the information or media sources which were not associated with compliance are not of potential use in educating visitors regarding low impact behavior or human impact in the meadow. These information sources did not predict compliant behavior in the summer of 1987 at Paradise Meadows. It is possible that if media or activities were changed, they might influence visitor behavior in the future.

The strength of statistical associations reported in this study, even when combined, are weak. However, if one accepts the intuitive argument that the sample of compliers contains a significant number of off-trail hikers which attenuate the strength of statistical associations, then the results may be considered more powerful. However, the extent to which statistical relationships are attenuated is unknown.

Three of the four most important variables associated with noncompliance are factors that can be influenced by park management. If one assumes a causal relationship between these variables and off-trail hiking, implications are evident for management intervention.

First, the variable that best predicts compliant behavior is personal attitude toward the harmfulness of off-trail hiking. This finding suggests an important theme for interpretive media. This theme should emphasize personal responsibility and the idea that: "your behavior can damage the meadow." Second, an important theme is suggested for interpretive media in the

relationship between perception of human impact and off-trail hiking. This message should emphasize that there is an unacceptable level of human impact in the meadow and simply stated, "The meadow is damaged and your behavior can add to the problem". Third, the finding that people who said they read written trail head signs are less likely to be noncompliers suggests that the accessibility of this media should be emphasized. The first and second points suggest message content for trailhead signs.

The second variable to enter the discriminate function was the dummy variable identifying those visitors having an out-of-state residence. The statistical relationship indicates that visitors with instate residence are more likely to be noncompliers. A local information campaign might have some influence on local visitors who are more likely to engage in off-trail hiking in the Paradise area.

With the exception of residence, social demographic characteristics in the survey data do not predict compliant behavior as well as the information exposure variables and the psychological variables. With the possible exception of local visitors, the survey indicates that among noncompliers over sixteen years of age who are not foreign residents, there is not an identifiable demographic subpopulation that can be targeted with specific communication strategies. However, the results from the sign experiment contain data analysis of behavior by a mixed racial/ethnic category suggest higher rates of noncompliance from non-white visitors - especially those in large groups.

SUMMARY AND CONCLUSIONS

In general, the research results suggest that intervention strategies to discourage off-trail hiking among visitors over 16 who are American citizens should be broadly directed toward all park visitors. First, a persuasive communication strategy should be designed to increase visitor awareness of the degree of existing undesirable human impact in the meadow. Second, persuasive communications might be designed to enhance individual visitor perceptions of the harmful consequences of individual off-trail hiking. Third, signs that unequivocally communicate expected behavior and noncompliant behavior consequences are indicated. This approach should combine trailhead and trailside signs. The trailhead signs would communicate the persuasive information. The trailside signs would reinforce behavioral expectations at likely off-trail hiking sites with possible negative sanctions indicating the agency commitment to resource protection, when necessary (Swearingen and Johnson, 1988). The trailside sign text is a very important part of this strategy and is considered in the companion report. The overall recommendations for social control techniques are developed in a separate document and include the results of the sign experiment.

BIBLIOGRAPHY

Blalock, Hubert M., Jr. 1979. Social Statistics. McGraw-Hill Book Company, New York.

Johnson, Darryll R. and Thomas C. Swearingen. 1986. A preliminary analysis of day hiker off-trail hiking in response to alternate sign texts at selected sites in the Paradise Meadows area, Mount Rainier National Park. NPS-CPSU, University of Washington, Seattle.

Swearingen, Thomas C. and Darryll R. Johnson. 1986. Mount Rainier National Park Paradise Meadow Visitor Survey. NPS-CPSU, University of Washington, Seattle.

Swearingen, Thomas C. and Darryll R. Johnson. 1988. An Analysis of Off-Trail Hiking in Response to Selected Social Control Techniques at Paradise Meadows, Mount Rainier National Park. NPS-CPSU, University of Washington, Seattle.

U.S. Bureau of the Census. 1985. Statistical Abstract of the United States: 1986 (106th Edition). U.S. Department of Commerce. U.S. Government Printing Office, WA., D.C.

Appendix A

ON SITE SHEET

OMB 10-24-0036

DATE_____ TIME_____
(MO./DAY/YR.) (24 HR. CLOCK)

LOCATION_____ I.D. NO._____

1987 PARADISE MEADOWS VISITOR SURVEY

1. NAME_____

PERMANENT ADDRESS_____

CITY_____STATE/COUNTRY_____ZIP CODE_____

2. What is the makeup of the group that you are day hiking with at this time? (Please circle one number)

1 INDIVIDUAL
2 FAMILY
3 FRIENDS
4 FAMILY & FRIENDS
5 ORGANIZED TOUR GROUP
6 OTHER GROUP NAME OF GROUP _____
(Please specify)

3. How many people are there in the group that you are presently day hiking with?

NUMBER OF PEOPLE_____

5. What is your age? _____YEARS

ADM. USE ONLY - DO NOT WRITE BELOW THIS LINE

PARTY CHARACTERISTICS							
AM	AF	TM	TF	KM	KF	PSM	PSF

☐ C ☐ NC

☐ NCF ☐ NCG

SUBJECT GENDER ☐ M ☐ F

2nd STAGE SAMPLE ☐ Y ☐ N