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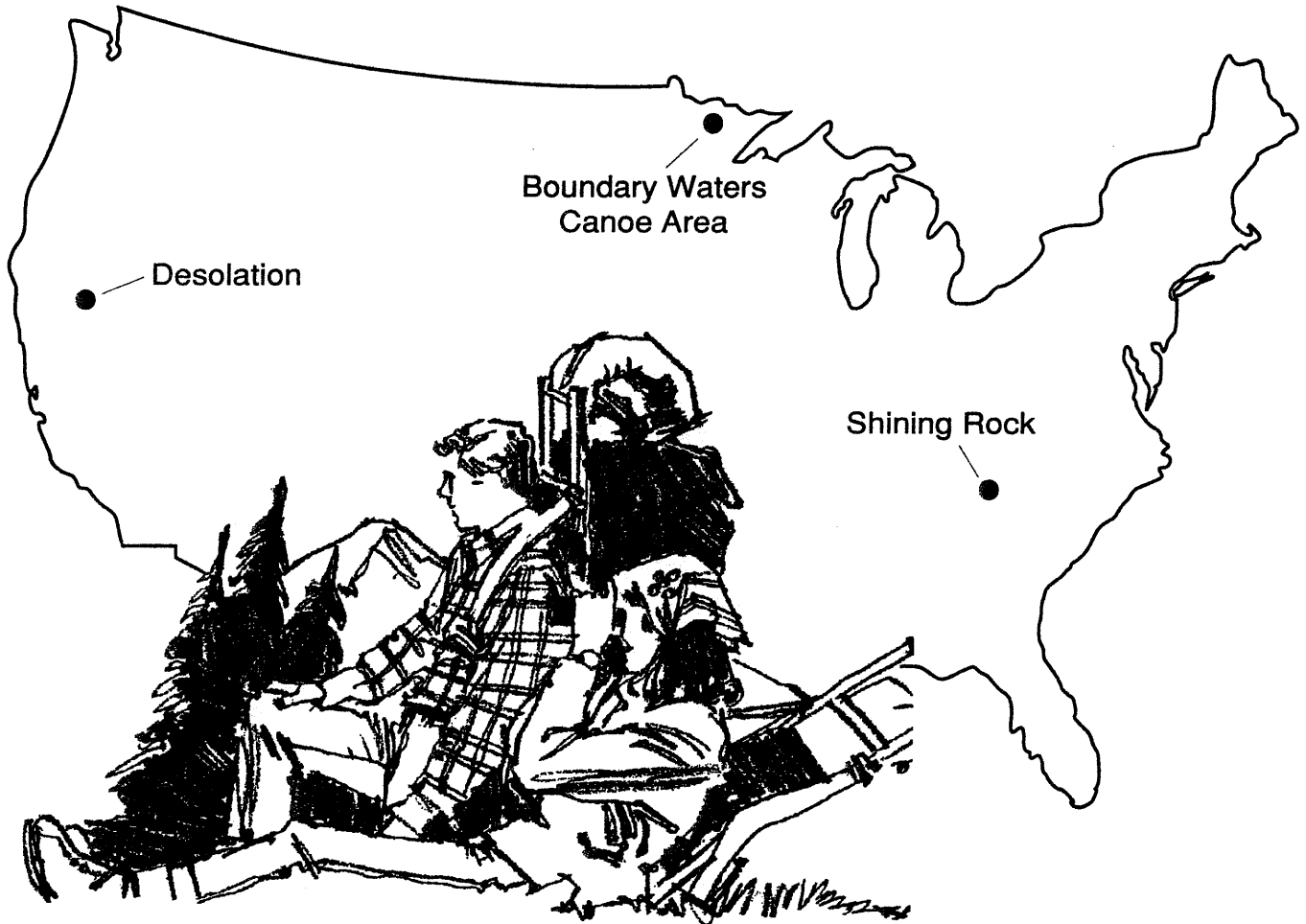
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Trends in Wilderness Visitors and Visits: Boundary Waters Canoe Area, Shining Rock, and Desolation Wildernesses

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Research Summary

To better understand trends in wilderness visitors, we replicated earlier visitor surveys in the Boundary Waters Canoe Area Wilderness, MN, in the Shining Rock Wilderness, NC, and in the Desolation Wilderness, CA. In addition to differences between these areas in region and predominant mode of travel, studies varied methodologically and in the time period studied. The years 1969 and 1991 were compared in the Boundary Waters, 1978 and 1990 in Shining Rock, and 1972 and 1990 in Desolation. Results were also compared with an earlier study of visitors to the Bob Marshall Wilderness Complex, MT, in 1970 and 1982 (Lucas 1985).

Only five out of 83 variables changed consistently in these three wildernesses and the Bob Marshall. In these wildernesses, visitor age and educational attainment increased as did the proportion of females and the proportion of visitors who had been to other wildernesses.

Visitor evaluations of litter in wilderness also consistently improved. Perhaps the most dramatic of these changes was the decrease in wilderness participation by those less than 25 years old. Other variables, such as previous experience in this specific wilderness and participation in hunting, increased substantially in some of these wildernesses but decreased substantially in others.

Characteristics of the people who visit wilderness areas have changed more than the types of trips they take, their evaluations of the conditions they encounter, or their preferences for conditions and management. Typical wilderness visits remain relatively unchanged. Some evidence suggests that solo visitors are more common and organized groups are less common, and that groups are smaller and stays are shorter. However, all of these changes are subtle at best; in most cases, differences were not statistically significant.

No clear evidence supports the idea that the wilderness visitors of today are any more or less tolerant of encounters with other groups than earlier visitors. Among Shining Rock users, tolerance of encounters appears to have increased over time. However, it decreased among Boundary Waters users and was unchanged among Desolation overnight users. Again, most of these differences were subtle as well as inconsistent.

Also no clear evidence emerged for a decline in the impact potential of groups or for a shift from consumptive to contemplative activities, trends suggested by Lucas (1985) for the Bob Marshall.

The relatively small number of variables that changed consistently suggest that managers should be skeptical of the broad generalizations about wilderness visitor trends that are occasionally advanced. Little evidence supports the idea that the visitors of today or the trips they take are substantially different from those of a decade or two ago. In the cases where important changes have occurred, the existence of change can only be identified with any confidence by conducting a visitor study specific to that wilderness.

Acknowledgments

We want to thank the numerous individuals who helped with the data collection, entry, and analysis of all these visitor surveys. We are particularly grateful to Bob Lucas and George Stankey who initiated the original visitor surveys we were able to replicate.

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Introduction

In 1964, the Wilderness Act created the National Wilderness Preservation System (NWPS). That system—originally 54 wildernesses and 9 million acres—has changed substantially since then. Both the number of wildernesses and wilderness acreage have increased more than eleven-fold. Wilderness diversity has also increased. The largest wilderness—Wrangell-St. Elias—is almost as large as the entire original NWPS. The smallest wilderness—Oregon Islands—at 5 acres is more than 1,000 times smaller than the smallest wilderness initially included in the NWPS. Wilderness areas are no longer so highly concentrated in the West and in the high mountains. Wilderness areas are found in all but six states and contain about 60 percent of the basic ecosystem types found in the United States (Davis 1989).

Although the wilderness system has clearly changed, relatively little information is available about how individual wilderness areas and their users have changed. Information about trends is needed so management can more effectively grapple with current issues and anticipate future issues. This report is the third in a recent series that deals with wilderness trends over the past 10-20 years. The two earlier papers reported on trends in wilderness campsite conditions and distributions (Cole 1993; Cole and Hall 1992). This paper reports on trends in wilderness visits, visitor characteristics, and visitor attitudes and preferences in three wildernesses in different parts of the United States.

Prior to the visitor trend studies reported here, there had been only one detailed visitor trend study—visitors to the Bob Marshall Wilderness Complex, Montana—the contiguous Bob Marshall, Scapegoat, and Great Bear Wildernesses (Lucas 1985). That study found few differences in characteristics of visitors to the Bob Marshall in 1970 and 1982. The differences considered to be most pronounced were more hikers relative to horse and mule users in 1982, smaller party

sizes, shorter lengths of stay, less use of outfitters, more summer use relative to fall use, a wider distribution of use across trailheads, some shift in activities from more consumptive to more contemplative, and less dependence on wood fires in 1982. The same study also found an increase among 1982 visitors in the proportion of women, education levels, and professional and technical occupations, and a decrease in amount of previous experience in the Bob Marshall Wilderness Complex. Visitors in 1982 were more concerned about crowding, conflict, and poor trails and were less able to find their desired level of campsite solitude. They were more likely than 1970 visitors to feel that soil and vegetation impacts were a problem and less likely to feel that litter was a problem.

These findings have been cited in attempts to generalize about overall trends in wilderness. For example, Roggenbuck and Lucas (1987) suggest there may be a trend toward fewer wilderness impacts per party, while Roggenbuck and Watson (1988) suggest that groups are getting smaller, and stays are getting shorter. However, these changes may be unique to the Bob Marshall Wilderness Complex, which is an unusual area in a number of ways: it is one of the largest wilderness complexes outside of Alaska and is unusual in the amount of horse, outfitter, and hunting use it receives.

The only other long-term visitor study in a wilderness-like area was conducted in the back-country of the Great Smoky Mountains National Park in 1973 and 1983 (Burde and Curran 1986). Trend data were available for only a few variables. As in the Bob Marshall, recent visitors were older, more likely to be women, and they came in smaller parties. In contrast to the Bob Marshall, recent visitors to the Great Smoky Mountains National Park had more experience with wilderness, were more likely to be family groups, and had no change in length of stay.

The need for a better understanding of wilderness visitor trends led us to undertake studies in a greater diversity of wilderness areas. It was only possible to

study trends in wildernesses with past visitor survey data; hence options were limited. We selected three wildernesses: the Boundary Waters Canoe Area in Minnesota, the Shining Rock in North Carolina, and the Desolation in California. When added to existing data from the Bob Marshall, these case studies provide examples from four different regions with substantial wilderness acreage. They encompass substantial variation in mode of travel—with two predominantly hiker wildernesses, one canoe wilderness, and one wilderness with substantial stock use. However, the examples do not vary much in use intensity. Although the Bob Marshall Wilderness Complex is relatively lightly used, the three wildernesses examined in this report are all heavily used.

The characteristics examined and the periods of study vary between areas. Desolation visitors were surveyed in 1972 and 1990; Boundary Waters visitors were surveyed in 1969 and 1991; and Shining Rock visitors were surveyed in 1978 and 1990. Only overnight visitors were studied at Boundary Waters; at Shining Rock, all visitors were studied as a single population; and day-users and overnight visitors were studied separately at Desolation. Due to these differences, each wilderness is treated as a separate case study.

As will become apparent, the results of each case study are detailed and complex. The interested reader can derive considerable information from these detailed results. Others may find it easier to skip over much of the detail, concentrating on the conclusions presented at the end of each case study (pages 7, 16, and 29) and the synthesis, summary, and management implications sections at the end of this report.

Boundary Waters Canoe Area Wilderness Case Study

The Boundary Waters Canoe Area Wilderness is a 1,086,914-acre wilderness in northern Minnesota. It was incorporated into the National Wilderness Preservation System by the 1964 Wilderness Act and was enlarged slightly in 1978. It is the largest Forest Service wilderness east of the Rocky Mountains and is the most heavily used wilderness in the entire country. Although it receives more total recreation use than either the Desolation or Shining Rock Wildernesses, use per acre is only about 25 percent of those two wildernesses. Lakes set in a glacially scoured, low-relief landscape characterize the area. Most use is by non-motorized canoe, although motors are allowed on about one-quarter of the water surface. Some hiking occurs.

In 1969, visitors were surveyed in a study conducted by Stankey (1971, 1973). The study reported here replicated portions of Stankey's survey. Between 1969

and 1991, recreation use increased about 75 percent, from 800,000 visitor-days to 1.4 million visitor-days. Motorized use declined from about 38 percent of total use to about 10 percent. Overnight and motorized users must obtain a permit for entry. This system limits the number of overnight groups that can enter at each trailhead every day; as a result, use is now distributed more evenly across trailheads. Eight out of 62 water access trailheads accounted for nearly 80 percent of use in 1969. In 1990, the eight most popular trailheads accounted for just 50 percent of all use.

Use is widely distributed internally because there are 260,000 acres of surface water for paddling (1,175 lakes of 10 acres or more and several hundred miles of stream) and 178 miles of portage trail between lakes. Visitors are required to camp at designated campsites, except in a few remote places. There are over 2,000 designated campsites in the wilderness. Each designated site has a fireplace and a toilet. In 1991, the group size limit was 10, a limit that was first imposed during the 1970's. Other regulations include a maximum stay at any campsite of 14 days and a prohibition on nonburnable, disposable food and beverage containers.

Study Methods

Sampling—In 1969, field workers contacted a sample of overnight visitors exiting from 14 moderate and heavy-use accesses. These access points accounted for more than 70 percent of all use in 1969. Visitors exiting from lightly used accesses were not included. All visitors over the age of 15 were asked to participate in the survey. If they agreed to participate (99 percent did), they were given the option of completing the survey at that time or providing their name and address for later receipt of the survey at their homes. The 1969 survey was conducted on 36 days between mid-May and early September, and it provided 152 usable surveys (73 percent response rate).

The sample in 1991 was designed to replicate, as nearly as possible, the 1969 sample. Like the 1969 sample, it was not strictly representative of Boundary Waters' users. The specific weekends and weekdays when sampling was conducted were chosen to approximate the days when the 1969 sampling was conducted. Interviewers contacted overnight visitors who were entering on these target dates at the same accesses surveyed in 1969. Names and addresses of all party members were obtained, and these visitors were mailed a questionnaire after they returned from their trip. This sample produced 215 usable surveys (74 percent response rate).

Analysis—Data were reported only for overnight visitors who entered (1991) or exited (1969) at 14

moderate- and heavy-use trailheads. However, an opportunistic sample of 80 visitors to 25 light-use trailheads was also conducted in 1991. This allowed us to evaluate the representativeness of our sample of overnight visitors at moderate- and heavy-use trailheads by comparing it to our sample of visitors at all 39 trailheads sampled in 1991. These trailheads accounted for 80 percent of the overnight use in the Boundary Waters in 1991. Responses of low-use trailhead entrants were weighted so that the proportion of responses from each trailhead reflected the proportional distribution of permits across trailheads.

The significance of differences between our 1991 sample of visitors who used the accesses sampled in 1969 and our broader sample of 1991 overnight visitors were evaluated using *t*-tests and chi-square tests. No significant differences between the sample of visitors to trailheads surveyed in 1969 and visitors to the larger set of trailheads were found. This suggests that results are likely to be generally applicable to all summer-season overnight visitors—not just those who used the high- and moderate-use trailheads included in the replicated sample.

We tested the significance of differences between 1969 and 1991 with *t*-tests and chi-square. For some variables, transformations were made to meet assumptions of normality and homogeneous variances. Differences were considered statistically significant when probabilities were less than or equal to 0.05.

For some of the variables, such as household income, responses were in discrete classes, some of which had no upper bound (such as income greater than \$75,000). For these variables, the significance of differences was assessed with *t*-tests based on the midpoints of each class. For classes without an upper or lower bound, a likely median value was assigned to each response in that class. For example, all visitors who responded that their income was greater than \$75,000 were assigned an income of \$100,000. The median was used as a measure of central tendency and was calculated by identifying the class that contained the median and then interpolated to estimate the precise median.

The variables analyzed in this way were educational attainment and household income.

Results have been subdivided into four categories: visitor characteristics, visit characteristics, wilderness conditions and evaluations of those conditions, and visitor preferences for social conditions.

Visitor Characteristics

Both sociodemographic characteristics and measures of previous wilderness experience can be described.

Sociodemographic Trends—Most of the sociodemographic variables studied changed significantly between 1969 and 1991 (table 1). Visitors were older in 1991 than in 1969, and they had higher levels of educational attainment and incomes. They were also less likely to be students and more likely to be members of a conservation organization. The proportion of visitors that were female (29 percent) was unchanged over the period.

Lucas (1964) reported that in 1960, 30 percent of paddle canoeists were under age 16 in the Quetico-Superior area (of which Boundary Waters is a part); in 1991, only 9 percent of overnight visitors were under the age of 16. Along with our finding that the median age of our sample increased from 25 in 1969 to 37 in 1991, these figures suggest a major shift in clientele—from children and young adults to mature adults.

About two-thirds of the overnight visitors to the Boundary Waters come from the state of Minnesota. For most of the sociodemographic characteristics we studied, wilderness visitors differed substantially from the general population of Minnesota. Differences between Boundary Waters visitors and the general population decreased between 1969 and 1991 for some characteristics and increased for others. Males, students, and conservation organization members were overrepresented among wilderness visitors in both 1969 and 1990. During this period, students' overrepresentation declined, the overrepresentation of conservation organization members increased, and

Table 1—Sociodemographic characteristics of overnight visitors, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

Year of study	Mean age	Median educational attainment	Students	Females	Conservation organization members	Median household income
	-----Years-----		-----Percent of overnight visitors-----			1990 dollars
1969	25	13.1	51	29	14	31,500
1991	37	16.4	18	29	35	43,000
Sign.	<0.001	<0.001	<0.001	0.85	<0.001	<0.001

Table 2—Educational attainment of 1969 and 1991 overnight visitors to the Boundary Waters Canoe Area Wilderness, and of the population of Minnesota.

Year of study	Educational attainment					Median Years
	Not high school graduate	High school graduate	Some college	College graduate	Graduate study	
----- Percent of overnight visitors/population -----						
Boundary Waters visitors						
1969	20	29	30	6	15	13.1
1991	6	16	22	15	41	16.4
Minnesota population						
1970	42	35	12	7	4	12.3
1990	18	33	28	16	6	12.9

the overrepresentation of males was unchanged. In 1969, wilderness visitors had slightly higher levels of educational attainment and income than the general population (tables 2 and 3). For these two variables, differences between wilderness visitors and the general population increased greatly over the period.

In 1969, wilderness visitors were substantially younger than the general population of Minnesota; by 1991, the median age of overnight visitors was approximately the same as the median age for the general population. The median age of survey respondents in 1991 was 36; however, only group members

over the age of 15 were included in the survey. When the 9 percent of visitors who were under 16 years old are included, the median age of all overnight visitors was 34 (compared to a median age of the general population of 33).

Wilderness Experience Trends—All measures of previous wilderness experience changed significantly between 1969 and 1991. The proportion of visitors on their first wilderness trip decreased, and the proportion that had been to wildernesses other than the Boundary Waters increased (table 4). The typical 1991 user visits wilderness about as frequently as

Table 3—Annual household income in 1990 dollars of 1969 and 1991 visitors to the Boundary Waters Canoe Area Wilderness, and of the population of Minnesota.¹

Year of study	Annual household income						Median 1990 dollars
	<10,000	10,000-19,999	20,000-34,999	35,000-49,999	50,000-74,999	>75,000	
----- Percent of overnight visitors/population -----							
Wilderness visitors							
1969	7	6	45	28	7	7	31,500
1991	4	9	26	24	23	14	43,000
Minnesota population							
1970	17	17	31	18	11	6	29,000
1990	14	17	25	20	16	8	31,000

¹Incomes of 1969 and 1991 visitors and from the 1970 census were adjusted using the implicit price inflator for gross national product. Classes were adjusted to be constant between years. This required some interpolation.

Table 4—Previous wilderness experience of overnight visitors, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

Wilderness experience variable	1969	1991	Significance
First-time wilderness visitors (percent)	31	12	<0.001
Experience in other wilderness areas (percent)	45	58	.01
Mean age at first wilderness visit (years)	16	25	<.001

Table 5—Typical wilderness visitation frequency of overnight visitors, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

Year	Wilderness trip frequency			
	Less than once every 2 years	About once every 2 years	About once per year	More than once per year
-----Percent of overnight visitors-----				
1969	23	9	24	43
1991	15	19	33	34
$X^2, p = 0.003$				

the typical 1969 user did; however, variation among users declined over the period (table 5). Visitors in 1991 were less likely than 1969 visitors to make frequent trips to wilderness; they were also less likely to visit wilderness very infrequently.

Visit Characteristics

The only significant change in visit characteristics between 1969 and 1991 was an increase in the proportion of groups that contained family members (table 6). Our 1991 sample of visitors differed from the 1969 sample by having more solo visitors, fewer organized groups, smaller mean group size, and a shorter length of stay. However, none of these differences were statistically significant.

Social Conditions and Evaluations of Those Conditions

Visitors were asked how many other groups they saw during their trip and whether or not they felt the Boundary Waters was crowded. If they felt it was crowded, they were asked how much that bothered them. The mean number of groups encountered was higher for the 1991 sample than for the 1969 sample, but the difference was not statistically significant (table 7). This result is not unexpected. Despite

a dramatic increase in overall use of the Boundary Waters, use levels have declined at some trailheads that were heavily used in 1969. Encounter levels of groups that entered at lightly used trailheads in 1969 would probably have increased more dramatically by 1991, but they were not included in the 1969 sample. Encounters with groups larger than 10 declined significantly. Again, this was expected, given that groups larger than 10 were prohibited in 1991.

Despite negligible change in reported encounter rates, more 1991 visitors felt that the Boundary Waters was crowded, at least in a few places (table 8). Visitors who felt the Boundary Waters was crowded were more likely to be bothered a lot by the crowding in 1991 than in 1969 (table 9). But 1991 visitors also were more likely to not be bothered by its being

Table 7—Social conditions encountered by overnight visitors, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

Social condition variable	1969	1991	Significance
Mean number of other groups seen per day	3.7	4.1	0.30
Mean number of large groups ¹ seen per day	.5	.1	<.001

¹Large groups were those with at least 11 members.

Table 6—Visit characteristics, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

Visit characteristic	1969	1991	Significance
Solo visitors (percent)	0.6	1.9	0.21
Organized groups (percent)	14.0	10.0	.12
Groups with family members (percent)	43.0	53.0	.05
Mean group size (people)	5.0	4.6	.34
Mean length of overnight stay (nights)	4.1	3.7	.30

Table 8—Opinions of overnight visitors about level of crowding, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

Visitor opinion	1969	1991
----- Percent -----		
Not overcrowded	69	44
Crowded in a few places	27	47
Crowded in most places	2	7
Did not notice	2	2
$X^2, p < 0.001$		

Table 9—Reaction of overnight visitors to crowding, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

If you felt crowded, did it bother you	1969	1991
	--- Percent ---	
No, not at all	13	24
Only a little	60	36
A moderate amount	23	29
It bothered me a lot	4	11

$X^2, p < 0.01$

crowded which suggests that 1991 visitors are more diverse in their reactions to social conditions in the Boundary Waters than 1969 visitors were.

Visitor Preferences for Social Conditions

Visitors were asked to imagine how they would feel about various levels of encounters (from 1 to 9 per day) that they might have with groups of paddle canoeists, motor canoeists, and motor boaters. They were also asked how they would feel about meeting “no other groups of people at all.” They were asked to express their feelings on a five-point scale from “very pleasant” to “very unpleasant.” Unfortunately, visitors were not asked how they would feel about meeting “no other paddle canoeists,” “no other motor canoeists,” and “no other motor boaters.” Therefore, we can only compare feelings about meeting 1 to 9 paddle canoeists to no groups at all (instead of no paddle canoeists). Readers should keep this lack of strict comparability in mind when interpreting our results, but we do not feel that this lack of equivalence changes the basic findings.

Responses were expressed as the proportion of visitors that felt each level of encounters would be unpleasant or very unpleasant. In both years, the proportion of “unpleasant” reactions was lowest with encounter levels of 1 or 2 per day and higher with increasing numbers of encounters (fig. 1). The data suggest, however, that 1991 visitors were less tolerant of numerous encounters than 1969 visitors. Visitors in 1991 were less likely than 1969 visitors to find it unpleasant to meet 0-2 paddle groups per day, but they were much more likely to find it unpleasant to meet more than 2 paddle groups per day.

We tested the statistical significance of this apparent trend using logistic regression to define regression lines that approximated these data. This allowed us to evaluate whether the slopes of the lines were significantly different. Significant differences in slope would indicate that the relationship between visitor reactions and number of encounters has changed. The slope of the regression line fitted to the 1991 data is significantly steeper than that for the 1969

data, indicating that 1991 visitors are more negatively affected by increasing encounters than 1969 visitors. They are also less likely to react negatively to a relatively high level of solitude.

Similar patterns are evident for feelings about encounters with motor canoeists (fig. 2) and motor boaters (fig. 3). Slopes of regression lines fitted to the 1991 data are significantly steeper than those for the 1969 data, indicating that 1991 visitors are more negatively affected by increasing encounters than 1969 visitors. For these types of encounters, 1991 visitors react more negatively than 1969 visitors to all levels of encounters greater than zero. These data suggest minimal tolerance of any level of encounters with motorized craft.

This dramatic decrease in tolerance for motorized craft can be at least partially explained by the decline in motorized use in the Boundary Waters that has occurred since 1969. Motorized users constituted about 10 percent of our 1991 sample compared with about 40 percent of the 1969 sample. Paddlers are much less tolerant of meeting motorized groups than motorized users are. It also means that fewer groups actually met or expected to meet motorized groups. High expectations about not meeting motorized groups, reinforced by not meeting motorized groups, might make the idea of meeting motorized groups more unpleasant.

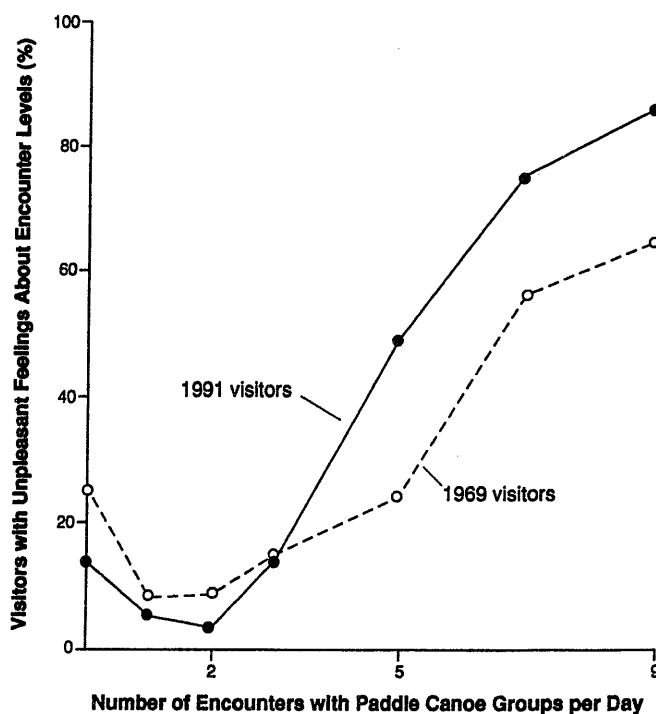


Figure 1—Proportion of visitors with unpleasant feelings about different numbers of encounters with paddle canoes, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

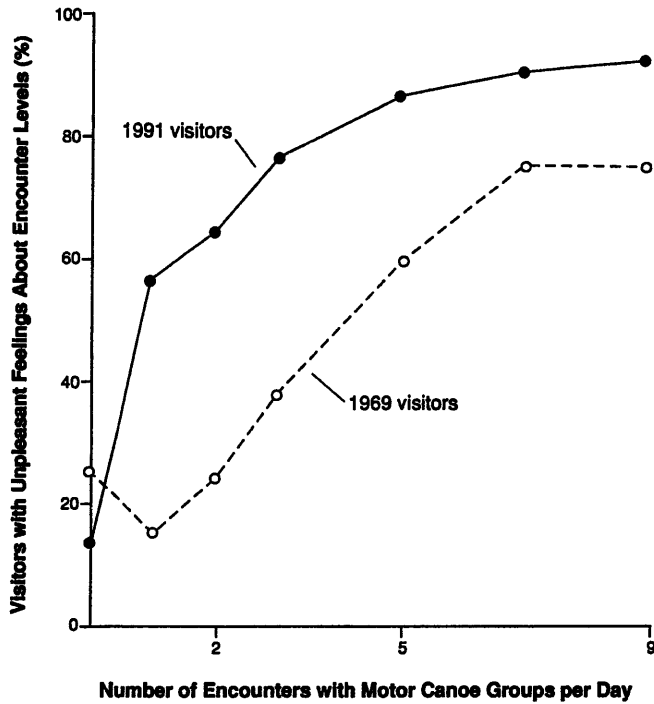


Figure 2—Proportion of visitors with unpleasant feelings about different numbers of encounters with motor canoes, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

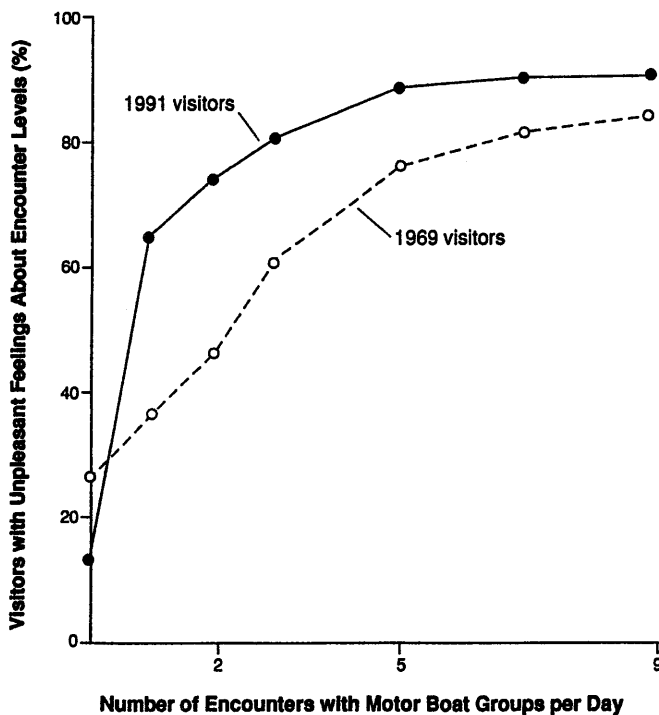


Figure 3—Proportion of visitors with unpleasant feelings about different numbers of encounters with motor boats, Boundary Waters Canoe Area Wilderness, 1969 and 1991.

We were able to control for the effect of the change in the proportion of motorized users in our sample by analyzing just the responses of paddle canoeists to encounters with the three types of groups. When just the opinions of paddlers are considered, differences between 1969 and 1991 are less pronounced. The slopes of the regression lines are still significantly different for encounters with other paddlers and with motor canoeists; in 1991 paddlers were less tolerant of increasing encounter levels than they were in 1969. However, paddlers were equally intolerant of encounters with motor boaters in 1969 and in 1991.

Conclusions

The following principal conclusions can be drawn about trends in overnight visitors to the Boundary Waters Canoe Area Wilderness between 1969 and 1991:

- Visitor characteristics changed more than characteristics of the wilderness visit, social conditions in the wilderness, visitor evaluations of those conditions, or visitor preferences about social conditions.
- The proportion of overnight visitors who are students declined while age, income, educational attainment, and the proportion of visitors who are conservation organization members increased. The ratio of males to females was unchanged. Differences between Boundary Waters visitors and the general population of Minnesota increased for certain variables and decreased for others.
- The previous wilderness experience of overnight visitors increased between 1969 and 1991. Typical wilderness visitation frequency remained unchanged over the period, but there was less variation in the 1991 population.
- The types of groups that visit the Boundary Waters and the types of trips that they take changed little over the period.
- Levels of inter-party contact were unchanged for the trailheads we sampled. However, more visitors felt the Boundary Waters felt crowded in 1991, and 1991 visitors were more likely to respond that it was “unpleasant” to meet increasing numbers of other groups. While these results suggest that 1991 visitors were generally less tolerant of encounters, the response of 1991 visitors to crowding was also more divergent than the response of 1969 visitors. The proportion of visitors who were not bothered by crowded conditions increased between 1969 and 1991, but so did the proportion of visitors who were bothered a lot.

Shining Rock Wilderness Case Study

The Shining Rock Wilderness is an 18,500 acre wilderness in western North Carolina. It was initially established by the 1964 Wilderness Act, one of only four areas east of the Rockies that were included in that Act. The wilderness was enlarged in the North Carolina Wilderness Act of 1984. As part of the Southern Appalachian highlands, the area is characterized by the rugged topography typical of the Blue Ridge Mountain Province. Much of the area was logged in the 1800's and early 1900's, and some was farmed. Today, most of the area is covered in dense forests. A few grassy balds occur on ridgetops and saddles, and these areas provide the most popular destinations for hikers and campers.

In 1978, Shining Rock Wilderness visitors were surveyed (Roggenbuck and others 1979, 1982). The study reported here replicated portions of that study. Since at least the mid-1970's, recreational use has been heavy on a per acre basis. Currently about 3 visitor-days per acre, use intensity is comparable to that in the Desolation Wilderness. Official estimates of recreation use indicate that current use levels are much lower than they were 10 to 15 years ago; however, expert opinion, observation, and results of this study suggest that current use levels are probably comparable to or even higher than those of 10 to 15 years ago. Most recreational use involves hiking on the 35-mile trail system, although there is some off-trail hunting and berry picking. Stock use is negligible. Access is provided at eight different trailheads, but one of these trailheads accounts for almost 50 percent of all use. Moreover, most trails converge at the half-acre grassy meadow, Shining Rock Gap. About one-third of the camping in the wilderness occurs in this area.

In the 1970's, all visitors were required to obtain a wilderness permit, but the number of permits was not limited and the only restriction was on length of stay, which could not exceed 2 weeks. Today, permits are no longer required and there are still few restrictions on use.

Study Methods

Sampling—The requirement for permits in 1978 provided an easy sampling method at that time. A systematic sample of permit holders—both day-users and overnight visitors—yielded 336 usable responses to a mailback questionnaire. Permit holders were asked to volunteer names and addresses of party members to allow further sampling. A 50 percent sample of volunteered party member names resulted in an additional 91 usable responses. The total sample

size for the 1978 Shining Rock study was 427 (a 78 percent response rate).

In 1990, without the permit system, interviewers contacted visitors during randomly selected blocks of time at eight trail entry points. There were no identifiable party leaders, since no permit was issued, so up to four persons per party were asked to participate in a mailback survey. From these contacts, 439 usable mailback surveys were obtained (a 75 percent response rate).

Unfortunately, these samples are not strictly comparable. The 1990 sample should be truly representative of all visitors over the age of 15. However, the 1978 sample is representative only of those visitors over the age of 15 who complied with the requirement to obtain a permit. Moreover, if compliance rates were lower for day-users than for overnight visitors, the sample would underrepresent day-users. In seven studies conducted elsewhere, day-users have always been found to register at trailheads less frequently than overnight visitors (Roggenbuck and Lucas 1987). At the Spanish Peaks Primitive Area in Montana, 72 percent of overnight visitors complied with a requirement to obtain a self-issued permit, while only 45 percent of day-users complied with this requirement (Lucas and Kovalicky 1981). If the characteristics and attitudes of day-users and overnight visitors are concurrent, then comparison of the 2 years is straightforward. However, where there are differences between day-users and overnight visitors, differences between the 1978 and 1990 samples may be a result of a real change in visitors, differences between the two sample populations, or both. We can test for differences between day-users and overnight visitors for some variables in 1978 and all variables in 1990. This will facilitate the interpretation of the trend data, but the reader should keep these differences in mind.

The 1978 sample also overrepresented party leaders. In 1978, however, there were only a few significant differences between party leaders and group members. Party leaders were more often male, more experienced, and often older (Roggenbuck and others 1979).

Analysis—The original data from the 1978 survey were not saved after final reports were published. This meant that comparisons had to be based on information contained in tabular presentations of the 1978 data. In most cases it was still possible to test the significance of differences between 1978 and 1990. Data from 1990 were categorized according to classes used in 1978 and chi-square tests were performed where appropriate. For categorized interval data, mid-points of classes were used to calculate means and to perform *t*-tests. For some variables, transformations were made to meet assumptions of normality and homogeneity of variances. Differences were considered

Table 10—Sociodemographic characteristics of visitors, Shining Rock Wilderness, 1978 and 1990.

	Mean age	Median education attainment	Students	Females	Conservation organization members
	----- Years -----		----- Percent of visitors -----		
1978	29	16.1	12	25	38
1990	35	16.6	16	31	39
Significance	<.001	.01	.05	.03	.74

statistically significant when probabilities were less than or equal to 0.05.

For some of the variables, such as household income, responses were in discrete classes some of which had no upper bound (such as income greater than \$75,000). For these variables, the significance of differences was assessed with *t*-tests based on the midpoints of each class. For classes without an upper or lower bound, a likely median value was assigned to each response in that class. For example, all visitors who responded that their income was greater than \$75,000, were assigned an income of \$100,000. The median was used as a measure of central tendency. It was calculated by identifying the class that contained the median and then using interpolation to estimate the precise median. The variables analyzed in this way were educational attainment, population of current residence, and number of previous visits to Shining Rock.

Results have been subdivided into four categories: visitor characteristics, visit characteristics, wilderness conditions and evaluations of those conditions, and visitor preferences for social conditions and management.

Visitor Characteristics

Both sociodemographic characteristics and measures of previous wilderness experience can be described.

Sociodemographic Trends—Most sociodemographic variables changed significantly between 1978 and 1990 (table 10). Visitors were older in 1990 than in 1978, and they had a higher level of educational attainment. They were also more likely to be students and more likely to be female. Membership in conservation organizations did not change over the period. A larger proportion of the 1990 sample came from cities with populations over 25,000, but this difference was not statistically significant (table 11).

The magnitude of most of these trends would probably be affected by an underrepresentation of day-users in the 1978 sample. Age and gender would also be affected by the overrepresentation of party leaders in the 1978 sample. Day-users were significantly older than overnight visitors in 1990 as well as significantly less likely to be students or conservation organization members and more likely to be female

Table 11—Current residence of 1978 and 1990 visitors to the Shining Rock Wilderness, and of the population of North Carolina and the United States.

	Farm or country	Town or city population				Median population
		<2,500	2,500-25,000	25,000-100,000	>100,000 or suburb	
----- Percent of visitors/population -----						
<i>People</i>						
Wilderness visitors						
1978	26	6	19	19	30	25,000
1990	24	6	17	27	25	32,500
National population						
1980	-----	34	-----	26	40	71,000
1990	-----	32	-----	27	41	69,000
North Carolina population ¹						
1980	-----	75	-----	10	15	7,500

¹1990 North Carolina census data were not available on this variable.

Table 12—Educational attainment of 1978 and 1990 visitors to Shining Rock Wilderness, and of the population of North Carolina.

	Educational attainment					Median Years
	Not high school graduate	High school graduate	Some college	College graduate	Graduate study	
----- Percent of visitors/population-----						
Shining Rock visitors						
1978	3	19	26	21	31	16.1
1990	6	13	22	15	44	16.6
North Carolina population						
1980	45	28	14	----- 13 -----		12.2
1990	30	29	24	----- 17 -----		12.7

or from a small community; there was no difference in educational attainment. Therefore, if day-users obtained permits less frequently than overnight visitors in 1978, the magnitude of the increase in mean age and the proportion of females, between 1978 and 1990, would be less than that reported here (table 10) while the magnitude of the increase in students would be even greater than reported here (table 10). Finally, the nonsignificant increases in conservation organization membership and population of current residence would be greater than reported here (table 10 and 11). The most likely effect of the overrepresentation of party leaders in 1978 is an overestimation of the increase in female participation that occurred between 1978 and 1990.

About 60 percent of our 1990 sample of visitors came from North Carolina. Compared with the entire population of North Carolina, males, students, and conservation organization members were overrepresented among wilderness visitors in both 1978 and 1990. Over this period, the overrepresentation of males declined, the overrepresentation of students increased, and the overrepresentation of conservation organization members was unchanged. Wilderness visitors tended to be much younger than the general population in 1978; by 1990, the age of wilderness

visitors was comparable to that of the general population. Wilderness visitors tended to live in larger communities than the general North Carolina population in 1978 (table 11). Although 1990 census data on this variable is not available yet, it appears that this difference did not change over the period. Wilderness visitors had much higher levels of educational attainment than the general population of North Carolina in both 1978 and 1990 (table 12). Over the period, educational attainment increased about equally for both wilderness visitors and the general population.

Wilderness Experience Trends—The previous experience of visitors with Shining Rock Wilderness did not change significantly between 1978 and 1990. In both years, about two-thirds of visitors had been to Shining Rock before, typically two or three times (table 13). However, 1990 visitors were more experienced in other wildernesses than 1978 visitors. The proportion of visitors who had been to other wildernesses increased from about one-half in 1978 to about three-quarters in 1990. One factor that might have contributed to this was the five-fold increase in the number of wildernesses in the southern Appalachians during this period.

Table 13—Previous wilderness experience of visitors, Shining Rock Wilderness, 1978 and 1990.

Wilderness experience variable	1978	1990	Significance
First-time visitors to Shining Rock Wilderness (percent)	38	34	0.29
Experience in other wildernesses (percent)	57	78	<.001
Median number of previous visits to Shining Rock Wilderness (number)	2.7	2.8	.48

Table 14—Wilderness visitation frequency of visitors, Shining Rock Wilderness, 1978 and 1990.

Visitation frequency variable	1978	1990	Significance
Mean number of wilderness visits in past 12 months (visits)	1.9	4.6	<0.001
Typical visitation frequency: more than 1 visit per year (percent)	66	71	.32

In both years, about two-thirds of visitors reported that they typically visit wilderness more than once per year (table 14). However, the mean number of wilderness visits in the past year increased from about two visits in 1978 to more than four visits in 1990. Frequency of wilderness visits in the past year is the only wilderness experience variable to differ significantly between 1990 day-users and 1990 overnight visitors. Day-users visited wilderness more frequently in the past year than overnight visitors. Therefore, if the 1978 sample underrepresented day-users, the reported increase in visitation frequency between 1978 and 1990 would be less pronounced than reported here.

Visit Characteristics

The only group characteristic that changed significantly was a decrease in mean group size from 4.4 in 1978 to 3.5 in 1990 (table 15). Despite this change in

Table 15—Method of travel, group size, and length of stay, Shining Rock Wilderness, 1978 and 1990.

Visit characteristic	1978	1990	Significance
Hiking groups (percent)	99	99	0.31
Mean group size (people)	4.4	3.5	.04
Solo visitors (percent)	10	13	.24
Day-use (percent)	32	46	<.001
Mean length of overnight visits (nights)	1.9	1.6	<.01

mean group size, the most common group size was 2. In each year, virtually all groups were hiking groups. The proportion of solo hikers did not change significantly either.

The likely underrepresentation of day-users in 1978 limits the definitiveness of conclusions about changes in length of stay. We can confidently conclude that the length of overnight stay decreased, the typical length of day trips probably decreased, and the proportion of day-use may have increased. The mean length of overnight visits decreased from 1.9 nights to 1.6 nights (table 15), with the proportion of visitors reporting that they typically stay out more than 2 nights declining from 18 percent in 1978 to 7 percent in 1990 (table 16). In 1978, only about 6 percent of visitors said they typically take day trips in wilderness that last for only a few hours. In 1990, 20 percent of visitors reported that their trips typically last for only a few hours (table 16). In 1978, 32 percent of the visitors sampled were on a day trip; this proportion increased to 46 percent in 1990 (table 15).

Of these visit characteristics, only changes in the proportion of solo visitors and of day-use would be different if day-users were underrepresented in the 1978 sample. Day-users were more likely to be traveling alone in 1990 than overnight visitors. Therefore, the nonsignificant increase, between 1978 and 1990, in solo visitors reported (table 15) would be even less pronounced. The increase in day-use reported (table 15) would also be less pronounced if day-users obtained permits less frequently than overnight visitors. For

Table 16—Reported typical lengths of stay when visiting wilderness, Shining Rock Wilderness visitors, 1978 and 1990¹.

	Typical length of stay			
	A few hours	Full day	1-2 nights	>2 nights
----- Percent of visitors -----				
1978	6	23	54	18
1990	20	24	49	7

X², p < 0.001

¹Visitors reported on their "typical" wilderness visit that might be different from their current visit to Shining Rock Wilderness.

example, if the permit compliance rates that Lucas and Kovalicky (1981) found were similar at Shining Rock (44 percent for day-users and 72 percent for overnight visitors), then the proportion of day-use at Shining Rock in 1978 would have been about 43 percent (instead of the 32 percent reported), and the increase in day-use between 1978 and 1990 would have been negligible. Unfortunately, given the uncertainty of compliance rates in 1978, we cannot confidently draw any conclusions about whether or not there has been any change in the proportion of day-use.

Wilderness use at Shining Rock is highly concentrated in space and in time. Concentration generally increased between 1978 and 1990 (table 17). The relative proportion of summer and fall use did not change, but the proportion of visitors who were there just on the weekend increased from 29 percent in 1978 to 48 percent in 1990. The proportion of weekday-only use declined from 40 percent to 30 percent. Trailhead use concentration increased, with the proportion of use entering at the three most popular trailheads increasing from 85 percent to 91 percent. The proportion of camping that occurred at the three most popular camping areas increased, within our samples, from 54 percent to 62 percent, but this increase was not statistically significant. Concentration of use on the most popular trail segments was unchanged. Despite an increase in the concentration of use at a few trailheads, the internal distribution of use was relatively unchanged.

Wilderness Conditions and Evaluations of Those Conditions

As in the surveys in the other wildernesses, Shining Rock visitors were asked how many other groups they encountered as well as how generally satisfied they were with their trip. They also were asked how the number of people they actually encountered compared with their expectations. In contrast to the other surveys, Shining Rock visitors were asked their opinions about the severity of a much greater variety of problems—people problems, resource impacts, and problems created by management or lack of management. For each potential problem, visitors were asked whether it was “no problem,” a “small problem,” a “moderate problem,” or a “big problem.” They could also respond “don’t know.” Those responding “don’t know,” generally less than 5 percent of respondents, were deleted from the analysis. The ratings of problem severity were considered to be a four-point scale, permitting calculation of a mean problem severity rating. In contrast to visitor characteristics, differences between day-users and overnight visitors were examined in the 1978 sample and were relatively infrequent. This increases our confidence in both the direction and magnitude of the trends reported here.

Table 17—Use distribution, Shining Rock Wilderness, 1978 and 1990.

Use distribution variable	1978	1990	Significance
Fall use ¹ (percent)	44	43	0.97
Weekend only (Saturday-Sunday) use ² (percent)	29	48	<.001
Use of three most popular trailheads ² (percent)	85	91	.02
Use of three most popular trail segments ² (percent)	43	41	.37
Use of three most popular camping areas ² (percent)	54	62	.09

¹September-October use as a percent of June-October use.

²As a percent of all use.

Trends in Social Conditions and Visitor Evaluations

The 1990 visitors that we sampled encountered a mean of 6.5 groups per day (table 18) which is more than the mean of 5.4 groups per day encountered by 1978 visitors. We could not evaluate whether this difference is statistically significant because we did not have an estimate of variance for the 1978 sample. The 1990 visitors in our sample also encountered more large groups and had more groups camped within sight or sound of their campsite. As with total encounters, the magnitude of difference between years is probably sufficient to be considered a real change, but we cannot be sure. In 1990, encounter levels did not vary significantly between day-users and overnight visitors; therefore, we can be confident that these estimates are representative of comparable populations of wilderness visitors.

In both years, more visitors reported that intergroup contacts were about what they had expected than reported that visits either exceeded or were fewer than expected (table 19).

Visitors were asked to evaluate the severity of 10 “people problems” (table 20). Evaluations changed significantly for 8 of these 10 problems, but the

Table 18—Social conditions encountered by visitors to Shining Rock Wilderness, 1978 and 1990.¹

Social condition variable	1978	1990
Mean number of other groups seen per day	5.4	6.5
Mean number of large groups ² seen per day	1.2	1.6
Mean number of groups camped within sight or sound	1.3	1.6

¹It was not possible to evaluate the statistical significance of differences between 1978 and 1990.

²Large groups were those with at least 7 members.

Table 19—How social conditions compared to expectations, Shining Rock Wilderness, 1978 and 1990.

Relationship	Number of people seen		Number of large groups seen		Number of groups camped within sight or sound	
	1978	1990	1978	1990	1978	1990
----- Percent of visitors with expectations -----						
Saw fewer than expected	16	22	23	21	22	28
Saw about what expected	42	40	40	43	45	42
Saw more than expected	43	38	37	36	33	30
Significance	0.06		0.70		0.31	

magnitude of change was small. None of these were considered even a moderate problem by a majority of users and in every case 1990 visitors felt the problems were less severe. The most severe problems, in both years, were litter and too many people in certain places. Problem severity ratings for “large groups” and “too many people” declined between 1978 and 1990, despite the fact that 1990 visitors encountered more people, including more large groups. This suggests an increase in tolerance of encounters with others.

Trends in Visitor Evaluations of Resource Problems—Visitors were asked to evaluate the severity of 13 “resource problems” (table 21). Evaluations changed significantly for only 3 of these 13 problems. Visitors in 1990 considered problems with both poor trail maintenance and poor trail marking to be significantly more severe than 1978 visitors did. They considered problems with streambank erosion to be less severe. Few visitors considered any of these to be even moderate problems. The severity of the problems considered to be most severe—destruction of vegetation at campsites and firerings full of litter—was unchanged.

Trends in Visitor Evaluations of Management Problems—Visitors were asked to evaluate the severity of problems created by there being “too many rules and regulations.” They were also asked about problems related to the adequacy of seven different types of information. Visitors in 1990 felt that problems with “too many rules and regulations” were even less of a problem than 1978 visitors did (table 22). This is not surprising, given that there were very few rules and regulations in place. Few visitors considered the adequacy of information to be even a moderate problem. Of the seven information types, problem severity declined significantly for four types, increased significantly for one type, and was unchanged for the other two types. In 1978, day-users were less likely than overnight visitors to consider it a problem if they lacked information on when the area was heavily used. Therefore, if day-users were underrepresented in 1978, the decline in the severity of this problem between 1978 and 1990 may be less pronounced than reported here (table 22).

Summary of Visitor Evaluations of Wilderness Conditions—Very few visitors to Shining Rock considered people problems, resource impacts, or

Table 20—Visitor opinions about the extent of people problems, Shining Rock Wilderness, 1978 and 1990.

People problem	Mean problem severity rating ¹		
	1978	1990	Significance
Litter	2.5	2.2	0.001
Theft of personal property	1.3	1.1	<.001
Inadequate human waste disposal	1.8	1.7	.13
Vandalism	1.5	1.2	<.001
Pets off leash	1.5	1.4	.01
Off-road vehicles	1.6	1.3	<.001
Rowdy or noisy people	1.6	1.5	.81
Large groups	1.9	1.7	<.01
Too many people in whole area	2.1	1.9	<.01
Too many people in certain places	2.4	2.1	<.001

¹ Problem severity was rated on a 4-point scale as follows: 1 = no problem; 2 = small problem; 3 = moderate problem; 4 = big problem.

Table 21—Visitor opinions about the extent of resource problems, Shining Rock Wilderness, 1978 and 1990.

Resource problem	Mean problem severity rating ¹		
	1978	1990	Significance
Trails poorly maintained	1.4	1.7	<0.001
Trails poorly marked	1.8	2.0	.03
Too few bridges across streams	1.2	1.2	.15
Trails following abandoned roadbeds	1.4	1.4	.68
Destruction of vegetation on campsites	2.1	2.1	.69
Lack of suitable campsites	1.5	1.5	.77
No supply of drinking water at campsites	1.6	1.6	.92
Firerings full of litter	2.1	2.2	.81
Not enough privacy at campsites	2.0	1.9	.24
Polluted streams	1.5	1.5	.76
Not enough wildlife	2.0	1.9	.07
Annoying insects	1.5	1.5	.31
Streambank erosion	1.6	1.4	<.001

¹Problem severity was rated on a 4-point scale as follows: 1 = no problem; 2 = small problem; 3 = moderate problem; 4 = big problem.

Table 22—Visitor opinions about the extent of problems created by management and inadequate information, Shining Rock Wilderness, 1978 and 1990.

Problem	Mean problem severity rating ¹		
	1978	1990	Significance
Too many rules and regulations	1.1	1.0	0.02
Not enough information on:			
Where to find campsites	1.5	1.5	.72
Trail locations	1.6	1.8	.01
Trail conditions	1.6	1.6	.54
Number of other users	2.0	1.7	<.001
Where other users are likely to be	2.0	1.8	<.001
When area is heavily used	2.1	1.9	<.001
Area's natural and cultural history	2.1	1.9	<.001

¹Problem severity was rated on a 4-point scale as follows: 1 = no problem; 2 = small problem; 3 = moderate problem; 4 = big problem.

management programs to be more than small problems. Litter was the problem given the highest severity rating, and its perceived severity declined somewhat between 1978 and 1990. The only problems that increased in perceived severity were poor trail maintenance, poor trail marking, and information about trail locations. Visitors in 1990 were more tolerant of intergroup encounters than they were in 1978.

Visitors were also asked to indicate how generally satisfied they were with their trip. Mean satisfaction ratings did not change significantly between 1978 and 1990 (table 23). In both years, the most common response was "very satisfied."

Visitor Preferences for Social Conditions and Management

Visitors were asked to imagine various levels of encounters they might have during the day or at their

campsite and to estimate how satisfied they would be if they encountered that many groups. Possible ratings ranged from 100 percent satisfaction to 0 percent satisfaction. Visitors were also asked their opinions about the need for controls on the number of visitors and other potential management actions.

Visitors in 1990 reported lower satisfaction level estimates than 1978 visitors for their probable response to meeting no groups or one other group on a three-day trip; however, they reported higher satisfaction estimates for meeting 3 to 60 other groups (fig. 4). This suggests that 1990 visitors might be more tolerant of increasing numbers of encounters than 1978 visitors. Unfortunately, it was not possible to conduct regression analyses to test the significance of differences. An increase in tolerance would be consistent with findings that 1990 visitors had less of a problem with "too many people," despite somewhat higher encounter levels. However, all these changes are

Table 23—Overall satisfaction of visitors with trip, Shining Rock Wilderness, 1978 and 1990.¹

	Extremely dissatisfied 1	2	3	4	5	6	Extremely satisfied 7	Mean rating
----- Percent of visitors -----								
1978	1	0	4	2	16	52	25	5.9
1990	1	1	7	2	17	49	23	5.7
Significance								.08

¹Satisfaction with the trip was rated on a scale of 1 (extremely dissatisfied) to 7 (extremely satisfied), with 4.0 indicating a neutral feeling.

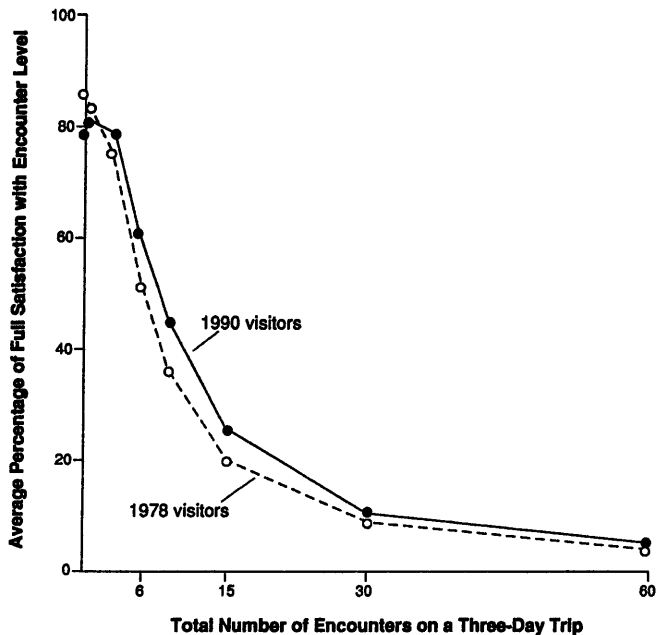


Figure 4—Reported satisfaction in relation to total encounters, Shining Rock Wilderness, 1978 and 1990.

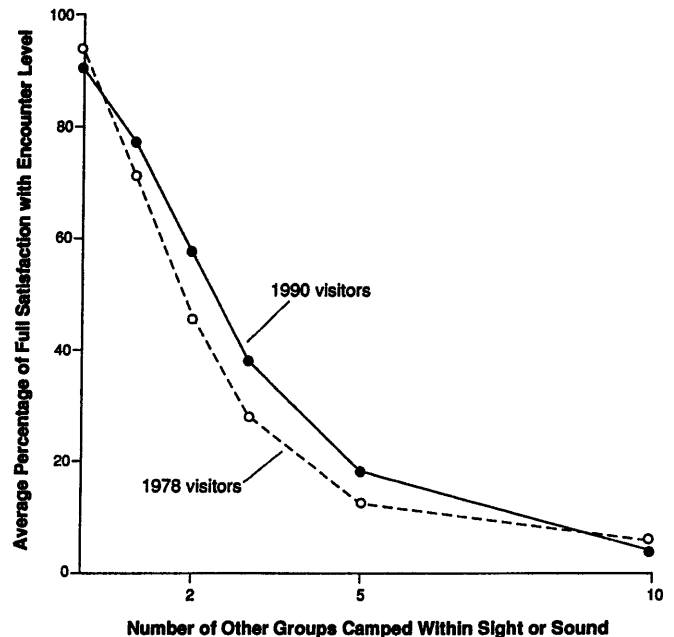


Figure 5—Reported satisfaction of overnight visitors in relation to campsite encounters, Shining Rock Wilderness, 1978 and 1990.

small and may not even be real changes (given our inability to test for statistical significance).

A similar pattern holds for campsite encounter preferences. Visitors in 1990 had lower satisfaction level estimates than 1978 visitors for no other groups camped within sight or sound, but they reported higher satisfaction estimates for one to five other groups camped within sight or sound (fig. 5). Reactions to ten other groups were comparable each year, and again, tolerance may have increased over the period.

Support for limiting amount of use did not change significantly between 1978 and 1990 (table 24). In

Table 24—Visitor opinions about the need for use controls, Shining Rock Wilderness, 1978 and 1990.

Extent of control needed	1978	1990
<i>Percent of visitors</i>		
Controls are needed now to lower use	24	24
Controls are needed now to hold use at current level	29	22
No controls needed now but should be imposed if overuse occurs	38	45
No controls now or in the future	9	9
$\chi^2, p = 0.07$		

both years, only 9 percent dismissed the idea entirely. The most common response, in both years, was that controls are not needed now but should be imposed in the future if needed. The sample proportions that thought controls were needed now declined from 1978 to 1990. The borderline statistical significance of this difference adds to the evidence that current users are more tolerant of interparty contacts, less likely to feel they are a problem, and less likely to want to control use levels to deal with crowding.

Additionally, visitor support for developing more trails declined to neutral over the period (table 25). Support for limiting group size and for providing information about where and when heavy use occurs was high in both years, but did not change significantly. The least popular management options in 1978—assigning departure dates, departure times, and campsites—remained the least popular options in 1990, but they were the options that gained the most support between 1978 and 1990.

Conclusions

The following principal conclusions can be drawn about trends in visitors to the Shining Rock Wilderness between 1978 and 1990:

- The variables that changed the most were socio-demographic characteristics of visitors, length of stay, and visitor evaluations of the severity of people problems. Changes in wilderness experience, group type, and other visitor preferences and evaluations were less pronounced.
- Age, educational attainment, and the proportion of visitors who were students and who were female increased over the period.
- Typical lengths of overnight stay decreased. Our results suggest that the proportion of day-use may have increased substantially if our 1978 sample had adequate representation of day-users. Unfortunately, we cannot be sure.

- Both the spatial and temporal concentration of use increased. Weekend use increased, as did the proportion of visitors that used the most popular trailheads.
- Visitors in 1990 appeared more accepting of frequent interparty contact than they were in 1978 and less likely to support management interventions to control levels of contact. Visitors in 1990 encountered more people than 1978 visitors did, but they also felt that people problems were less severe. Reported satisfaction decreased more slowly with increasing numbers of encounters in 1990 than in 1978. Finally, the proportion of visitors who thought that use controls were needed now declined over the period.
- Other significant changes were an increase in the proportion of visitors who had been to other wildernesses; an increase in the number of wilderness visits in the past year; a decrease in mean group size; an increase in the perceived severity of problems associated with trails—poor maintenance, poor trail markings, and inadequate information about trail locations; and an increase in support for management approaches that involve assigning departure dates, departure times, and campsites.

Desolation Wilderness Case Study

Desolation Wilderness is a 63,475 acre wilderness in the central Sierra Nevada in California. It was initially designated a primitive area by L-20 regulations in 1931. In 1967, it was enlarged to its present size and designated wilderness. It is located adjacent to Lake Tahoe and is well-known for relatively easy hiking, spectacular mountain scenery, and about 130 lakes, most of which are stocked with trout.

In 1972, Desolation visitors were surveyed in two separate studies (Lucas 1980, Stankey 1980). The

Table 25—Visitor support for certain management actions, Shining Rock Wilderness, 1978 and 1990.

Management action	Mean support rating ¹		
	1978	1990	Significance
Limit party size	3.8	3.9	0.33
Provide better information on where and when heavy use occurs	4.6	4.5	.70
Develop more trails	3.3	3.0	<.01
Assign departure points	2.4	3.0	<.001
Assign departure times	1.8	2.2	<.001
Assign campsites	2.0	2.4	<.001

¹Support was rated on a 5-point scale from 1 (strongly oppose) to 5 (strongly support). A 3.0 denotes a neutral opinion.

study reported here replicated portions of those two studies. Since the 1960's, use of the Desolation has been heavy on a per acre basis. Use estimates based on permit data suggest that use levels were similar in 1972 and in 1990. Most recreational use involves hiking on the approximately 100 miles of official trail, but the terrain is also conducive to off-trail hiking, which occurs to a limited extent. Access is provided by 15 trailheads. The distribution of use across these trailheads is relatively unchanged since 1972. The three most popular trailheads accounted for 57 percent of all use in 1972; these same three trailheads were also most popular in 1990 and, again, accounted for 57 percent of all use.

This lack of change in use distribution is surprising because trailhead quotas were established to try to provide a more even distribution of use. Permits were required for entry beginning in 1971. However, starting in 1978, the number of permits issued to overnight visitors was limited. Only a certain number of overnight groups were allowed to enter at each trailhead each day while the numbers of day-users has remained unlimited. In recent years, about 70 to 75 percent of all visits have been day visits. Other regulations include a limit on group size of 25 and a 14 day limit on length of stay. Beginning in 1990—the year of our follow-up study—all campfires were prohibited in the wilderness.

Study Methods

Sampling—In 1972, two systematic samples of visitor permits, beginning from random starts, were taken. In both samples, data were only obtained from permit holders. Other group members and visitors who failed to obtain a permit were excluded. This sampling method produced samples of 295 and 286 permit holders, with response rates to mailback surveys of 87 percent and 84 percent, respectively. Both day-users and overnight visitors were sampled for permits, but the samples were analyzed separately because it was clear that day-users would be underrepresented if the samples were combined.

In 1990, a systematic sample of visitor permits, starting from a randomly selected permit, yielded 438 usable surveys from an 83 percent response rate. Again, day-users and overnight visitors were sampled from permits, with each sample being analyzed separately. These separate analyses made it possible to avoid the interpretation problems we experienced at Shining Rock; however, separation increased the complexity of the results.

Additional complexity was added with our attempt to better understand how well permit holders (the sample population) represented the general population of Desolation Wilderness visitors. Two additional samples were taken to address this question. First,

to evaluate differences between permit holders and other party members, questionnaires were sent to a systematic sample of 109 party members. The list of names from which this sample was drawn was solicited from the permit holders as part of the mailback questionnaire. A final sample size of 81 party members (67.5 percent response) was obtained. Second, to evaluate differences between groups that obtained permits and those that did not, a convenience sample of 118 noncompliers were contacted inside the wilderness by rangers and asked a short set of questions.

Analysis—Trends for day-users and overnight visitors are described separately because we have no accurate estimate of the proportion of all visitation that was day-use, either for 1972 or 1990, and because we suspect that day-use permit compliance increased between 1972 and 1990 since day-use permits became more convenient to obtain. Consequently, combining the samples would probably have resulted in more underrepresentation of day-use in 1972 than in 1990. We used chi-square and *t*-tests to evaluate the significance of differences between visitors in 1972 and 1990. For some variables, transformations were needed to meet the assumptions of normality and homogeneity of variances. Differences were considered to be statistically significant when probabilities were less than or equal to 0.05.

For some of the variables, such as household income, responses were in discrete classes, some of which had no upper bound (such as income greater than \$75,000). For these variables, the significance of differences was assessed with *t*-tests based on the midpoints of each class. For classes without an upper or lower bound, a likely median value was assigned to each response in that class. For example, all visitors who responded that their income was greater than \$75,000, were assigned an income of \$100,000. The median was used as a measure of central tendency. It was calculated by identifying the class that contained the median and then using interpolation to estimate the precise median. The variables analyzed in this way were educational attainment, household income, and population of current residence.

The resulting data apply strictly to permit holders because only permit holders were compared in 1972 and 1990. However, we believe that trends among permit holders should be similar to those among the entire population of wilderness visitors. We used *t*-tests and chi-square tests to assess the significance of differences in 1990 between our sample of permit-holders and a larger sample of all visitors in groups that obtained permits. The sample of all visitors was obtained by combining the sample of permit holders with the sample of group members, after weighting the sample of group members by a factor of 2.1 to account for the mean group size of 3.1 people. There

were few statistically significant differences between the sample of permit-holders and the sample of all visitors. Those variables for which there was a significant difference between permit holders and all visitors, for either day-users or overnight visitors, are shown in table 26. Even for these variables, trends among permit holders would be similar to trends in the entire visitor population as long as differences between permit holders and the entire population did not change over time.

Differences between visitors who obtained permits and those who did not were seldom pronounced (Watson 1993). Only three of the variables examined differed significantly for both day-users and overnight visitors. Fewer noncompliers participated in photography, and noncompliers were generally younger and less educated than compliers. If compliance rates approached 95 percent, as reported elsewhere in the Sierra Nevada (DeGraff 1983), there are unlikely to be any significant differences between visitors who obtained permits and the entire population of wilderness visitors.

These analyses lead us to believe (despite our inability to prove it) that most, if not all, of the trends we identified from our samples of permit holders

would also have been found if our sample had been representative of all wilderness visitors—permit holders, other members of groups that obtained permits, and members of groups that did not obtain permits. In the presentation of results that follows, differences between permit holders and the larger population will be reiterated in introductory sections. Thereafter, the populations will be referred to as day-users and overnight visitors, even though only data for permit holders will be presented.

Results have been subdivided into four categories: visitor characteristics, visit characteristics, wilderness conditions and evaluations of those conditions, and visitor preferences for social conditions and management. Each section is subdivided further into trends among day-users and trends among overnight visitors. A brief description of differences between day-users and overnight visitors is also included.

Visitor Characteristics

Wilderness visitors can be described in terms of both their sociodemographic characteristics and their wilderness experience. Results apply strictly to permit holders. Consider the following statistically significant

Table 26—Variables for which there is a significant difference between permit holders and all wilderness visitors, Desolation Wilderness, 1990.

Variable	Day-users			Overnight visitors		
	Permit holders	All visitors	Significance	Permit holders	All visitors	Significance
Students (percent)	18	25	0.01	24	22	0.56
Females (percent)	34	48	.001	20	23	.47
First-time visitors to:						
Desolation Wilderness (percent)	37	46	.02	15	28	.03
Any wilderness (percent)	9	14	.05	2	5	.001
Mean number of previous visits to Desolation Wilderness	7	5	.10	10	7	.02
Mean number of wilderness visits in past 12 months	3.6	3.6	.55	4.6	3.4	.01
Activity participation (percent)						
Fishing	15	9	.01	41	41	.87
Hunting	2.8	.9	.03	4.8	1.5	.01
Nature study	51	56	.17	43	57	.001
Mean number of other groups seen per day	8.5	6.6	.01	4.0	4.2	.88
Percent who did not care how many people they saw	15	8	.01	4	5	.84
Mean "wear and tear" condition ¹	4.1	4.1	.45	3.7	3.9	.04
Mean preferred number of groups camped within sight and sound	1.0	1.1	.34	.6	.9	.01
Mean desirability of rock firerings ²	3.3	3.4	.15	2.8	3.1	.04

¹Condition was rated on a scale from 1 (very poor) to 5 (very good).

²Desirability was rated on a scale from 1 (very undesirable) to 5 (very desirable).

Table 27—Sociodemographic characteristics of visitors, Desolation Wilderness, 1972 and 1990.

Sociodemographic characteristic	Day-users			Overnight visitors		
	1972	1990	Significance	1972	1990	Significance
Mean age (years)	39	40	0.56	30	36	<0.001
Median educational attainment (years)	17.1	16.9	.28	15.8	17.1	<.001
Students (percent)	28	18	.03	44	25	<.001
Females (percent)	19	34	<.01	10	20	<.001
Conservation organization members (percent)	61	34	<.001	59	41	<.001
Median household income (1990 dollars)	48,000	49,750	45	42,500	45,000	17

differences between a sample of permit holders and a sample of all wilderness visitors (table 26) when deciding whether or not these results can be extrapolated to all visitors. Among day-users, permit holders were less likely to be students and more likely to be male than the entire population of day-users. They were also less likely to be on their first trip to Desolation or their first wilderness trip. For overnight visitors, no sociodemographic characteristics differed significantly between permit holders and all overnight visitors. Overnight permit holders generally had more wilderness experience than the entire population of overnight visitors. Additionally they were less likely to be on their first trip to Desolation or on their first wilderness trip. Permit holders also had made more previous trips to Desolation and had made more wilderness trips in the past year.

Sociodemographic Trends for Day-Users—

Three of the sociodemographic characteristics of visitors that we examined changed significantly between

1972 and 1990 (table 27). Day-users in 1990 were less likely than those in 1972 to be male, students, or members of conservation organizations. Eighty-seven percent of Desolation visitors came from California. Compared with the entire population of California, males, students, and members of conservation organizations were overrepresented among day-users both in 1972 and in 1990; however, the degree of overrepresentation declined over the period.

The age, educational attainment, and household income of 1990 day-users did not differ significantly from that of 1972 day-users. Age of the general California population was also relatively unchanged over the period, but educational attainment and income both increased substantially (tables 28 and 29). The educational attainment and income of day-users were substantially higher than that of the general population in 1972 and in 1990, but the difference declined over the period. The mean age of day-users was similar to the general population in both 1972 and 1990.

Table 28—Educational attainment of 1972 and 1990 day-users and overnight visitors to the Desolation Wilderness, and of the population of California.

	Educational attainment					Median
	Not high school graduate	High school graduate	Some college	College graduate	Graduate study	
	----- Percent of visitors/population-----					Years
Day-users						
1972	5	9	20	15	51	17.1
1990	2	8	24	18	48	16.9
Overnight visitors						
1972	8	12	31	15	34	15.8
1990	3	6	19	21	51	17.1
California population						
1970	27	31	22	----- 20 -----	-----	12.7
1990	24	22	31	15	8	13.4

Table 29—Annual household income in 1990 dollars of 1972 and 1990 day-users and overnight visitors to the Desolation Wilderness, and of the population of California.¹

	Annual household income						Median 1990 dollars
	<10,000	10,000- 19,999	20,000- 34,999	35,000- 49,999	50,000- 74,999	>75,000	
----- Percent of visitors/population -----							
Day-users							
1972	3	9	18	23	26	21	48,000
1990	3	9	16	21	20	30	49,750
Overnight visitors							
1972	10	12	19	18	23	17	42,500
1990	7	10	20	21	21	22	45,000
California population							
1970	15	15	28	20	14	8	30,750
1990	12	14	23	18	18	15	35,750

¹Incomes of 1972 visitors and from the 1970 census were adjusted using the implicit price deflator for gross national product. Classes were adjusted to be constant between years. This required some interpolation.

The median population of the current residence of day-users was smaller in 1990 than in 1972 (table 30). The proportion of day-users who reside in cities with populations greater than 50,000 declined from 63 percent to 50 percent, a nonsignificant change ($p = 0.07$). The size of community that the general population lived in was relatively unchanged over this period. Compared to the national population, the median

Desolation day-user lived in a larger community in 1972 and a smaller community in 1990. The 1990 census data were not available for California.

Sociodemographic Trends for Overnight Visitors—Five of the sociodemographic characteristics of visitors that we examined changed significantly between 1972 and 1990 (table 27). As was the case for day-users, the proportion of overnight visitors

Table 30—Current residence of 1972 and 1990 day-users and overnight visitors to the Desolation Wilderness, and of the population of California and the United States.

	Farm or ranch	Town or city with population of:					Median popula- tion People
		<1,000	1,000- 5,000	>5,000- 50,000	>50,000- 1 million	>1 million	
<i>Percent of visitors</i>							
Day-users							
1972	2	6	6	23	40	23	¹ 365,000
1990	2	5	7	37	26	24	50,000
Overnight visitors							
1972	1	4	5	28	49	13	283,000
1990	2	3	11	27	33	25	270,000
National population							
1970	-----	45	-----	-----	41	14	71,000
1990	-----	45	-----	-----	42	13	69,000
California population ²							
1970	-----	46	-----	-----	40	14	62,000

¹Magnitude of difference between 1972 and 1990 exaggerated by the large range of the 50,000 to 1 million population class.

²1990 California census data were not available on this variable.

that were males, students, and members of conservation organizations declined between 1972 and 1990. In contrast to day-users, age and educational attainment increased significantly between 1972 and 1990. The only sociodemographic variables that did not change significantly over this period were income and current residence.

The decreases in proportions of males, students, and conservation organization members as well as the increase in age far exceed trends in the general population. The increase in educational attainment (table 28) and the nonsignificant decrease in population of residence (table 30) mirror changes in the general population. Median household income increased about 6 percent, compared to a 16 percent increase in the median income of the general population (table 29).

Differences Between Day-Users and Overnight Visitors—In 1972, overnight visitors were generally younger than day-users; they also had less income and less educational attainment and were more likely to be male and students. Most differences persisted in 1990, but, with the exception of gender, differences became less pronounced. By 1990, divergences in educational attainment were no longer significant. Membership in conservation organizations was higher in overnight visitors in 1990 whereas it had not been in 1972.

Summary of Sociodemographic Variables—Significant changes occurred in all the sociodemographic characteristics of visitors that we examined except household income and population of current residence. For both day-users and overnight visitors, the proportion of students, males, and conservation organization members declined. Age increased for both user types, but the increase was statistically significant only for overnight visitors. Educational attainment increased significantly for overnight visitors, but not much more than it increased in the general population.

Wilderness visitors differed from the general population of California, both in 1972 and in 1990, in being more highly educated, having more income, living in a larger community (except for day-users in 1990), and having a greater likelihood of being male, a student, and a member of a conservation organization; however, all of these differences declined in magnitude between 1972 and 1990. Overnight visitors were also younger than the general population in 1972 and in 1990; but, by 1990, differences in age were minimal. The median age of the general population was 33 years in 1990. When the 12 percent of overnight visitors who were under the age of 16 are accounted for (visitors under 16 were not included in the sample), the median age of overnight visitors is 32 years.

These findings indicate that the sociodemographic characteristics of wilderness visitors have changed markedly over the past 20 years. Generally, differences between day-users and overnight visitors and between wilderness visitors and the general population have decreased since 1972.

Wilderness Experience Trends for Day-Users—Only one dimension of previous wilderness experience changed significantly—experience in wildernesses other than Desolation. The proportion of Desolation day-users that had been to other wildernesses increased from 53 percent in 1972 to 83 percent in 1990 (table 31), while the amount of previous experience at Desolation Wilderness was virtually unchanged. The proportion of day-users in our sample who were making their first trip to any wilderness declined from 15 percent in 1972 to 9 percent in 1990, but this difference was not statistically significant. None of the measures of wilderness visitation frequency changed significantly over the period. Most day-users (78-80 percent) typically visit wilderness more than once per year. Compared to the 1972 sample of day-users, the 1990 users we sampled had taken slightly fewer wilderness

Table 31—Previous wilderness experience of visitors, Desolation Wilderness, 1972 and 1990.

Wilderness experience variable	Day-users			Overnight visitors		
	1972	1990	Significance	1972	1990	Significance
First-time visitors to:						
Desolation Wilderness (percent)	37	37	0.93	33	15	<0.001
Any wilderness (percent)	15	9	.12	10	2	<.0001
Mean number of previous visits to Desolation Wilderness (number)	8	7	.93	5	10	<.001
Experience in other wilderness areas (percent)	53	83	<.001	61	94	<.001
Mean age at first wilderness visit (years)	20	21	.37	12	19	<.001

visits in the past 12 months and had spent fewer days in wilderness in the past 12 months; however, differences were not significant.

Wilderness Experience Trends for Overnight Visitors—The previous wilderness experience of overnight visitors increased substantially between 1972 and 1990. Experience both at Desolation and at other wildernesses increased. The proportion of overnight visitors on their first visit to Desolation Wilderness declined, and the mean number of previous trips to Desolation increased (table 31). The proportion on their first wilderness trip declined from 10 percent to just 2 percent, and the proportion that had visited wildernesses other than Desolation increased from 61 percent to 94 percent. Several measures of wilderness visitation frequency also increased (table 32). The proportion of overnight visitors who typically visit wilderness more than once a year increased, as did the mean number of wilderness trips in the past 12 months. Although the number of trips in the last year increased, days spent in wilderness was virtually unchanged. This tends to support the oft-heard generalization that people are taking more short trips.

Differences Between Day-Users and Overnight Visitors—In 1972, the previous wilderness experience of day-users and overnight visitors was similar. The only significant difference was that overnight visitors typically took their first wilderness trip at an earlier age than day-users (table 31). Divergence between day-users and overnight visitors became more pronounced between 1972 and 1990. In 1990, overnight visitors were less likely than day-users to be on their first Desolation trip and were more likely to have visited other wildernesses. Differences in visitation frequency between day-users and overnight visitors also increased between 1972 and 1990 (table 32). In 1990, overnight users visited wilderness more frequently than day-users, and they took more trips and spent more days in wilderness in the past year.

Summary of Wilderness Experience Variables—The previous experience levels and wilderness

visitation frequency of overnight visitors increased significantly between 1972 and 1990. For day-users, however, the only significant change was an increase in the proportion that had visited other wildernesses. Differences between overnight users and day-users increased over the period with overnight users becoming much more experienced and visiting wilderness more frequently than day-users.

Visit Characteristics

This group of variables describes the nature of the wilderness visits that people make. Wilderness visits can be characterized in terms of the types of groups that visit wilderness and the types of trips they take. With the following exceptions, responses of permit holders were similar to those of all visitors. Among day-users, 1990 permit-holders were more likely to hunt and fish than all visitors (table 26). Among overnight visitors, 1990 permit-holders were more likely to hunt and less likely to study nature.

Trends in Visit Characteristics of Day-Users—None of the group characteristics changed significantly (table 33). Virtually every group hiked rather than rode horses, both in 1972 and in 1990 (table 34). The proportion of groups that participated in various activities differed somewhat between years; however, the only significant change was increased mountain climbing (table 34).

Trends in Visit Characteristics of Overnight Visitors—As with day-users, none of the group characteristics changed significantly (table 33). Virtually every group hiked, both in 1972 and in 1990 (table 34). More groups hunted in 1990 than in 1972, while fewer groups fished and studied nature. The mean length of overnight trips declined significantly from 2.9 nights in 1972 to 2.3 nights in 1990 (table 35). In each year, the most common trip lasted 2 nights and more than 50 percent stayed no longer than 2 nights; however, the proportion of trips that exceeded 5 nights declined from 8 percent in 1972 to 3 percent in 1990. The number of separate campsites used on wilderness

Table 32—Wilderness visitation frequency of visitors, Desolation Wilderness, 1972 and 1990.

Visitation frequency variable	Day-users			Overnight visitors		
	1972	1990	Significance	1972	1990	Significance
Typical visitation frequency						
1 or more visits per year (percent)	78	80	0.74	81	92	0.002
Mean number of wilderness visits in past 12 months	3.7	3.6	.84	3.4	4.6	.01
Mean number of days in wilderness in past 12 months	7.3	5.4	.13	11.2	11.1	.92

Table 33—Type of group, Desolation Wilderness visitors, 1972 and 1990.

Group characteristic	Day-users			Overnight visitors		
	1972	1990	Significance	1972	1990	Significance
Organized groups (percent)	2.2	0.8	0.40	8.7	4.3	0.08
Groups with family members (percent)	79	73	.64	55	57	.52
Solo visitors (percent)	13	14	.95	10	13	.39
Mean group size (number)	3.7	3.1	.21	3.7	3.1	.18

Table 34—Method of travel, and activities visitors participated in, Desolation Wilderness, 1972 and 1990.

Visit characteristic	Day-users			Overnight visitors		
	1972	1990	Significance	1972	1990	Significance
Hiking groups (percent)	98.2	99.6	0.23	99.6	98.9	0.11
Activity participation (percent)						
Fishing	21	15	.19	53	41	.01
Hunting	1.9	2.8	.64	1.7	4.8	.02
Hiking	92	96	.20	95	94	.33
Photography	58	52	.34	60	60	.89
Nature study	49	51	.79	51	43	.05
Mountain climbing	1	6	.05	7	7	.73
Swimming	21	18	.46	53	46	.13

trips also declined, but the mean distance traveled during the wilderness visit increased significantly (if not substantially), from 15 miles to 17 miles. More of the groups in the 1990 sample traveled off-trail, and they traveled farther off-trail, but these differences were not statistically significant.

Differences Between Day-Users and Overnight Visitors—In 1972, overnight visitors were more likely than day-users to be in organized groups, and they were less likely to be accompanying family members. They were also more likely to fish, swim, and climb mountains. With the exception of mountain climbing, these differences persisted in 1990, with the magnitude of differences relatively unchanged. Compared to day-users, 1990 overnight visitors were more likely to fish, swim, hunt, and take photographs and less likely to study nature. Generally, trends were similar for both day-users and overnight visitors.

Per capita expenses, adjusted to account for inflation, were also estimated in both 1972 and 1990 (table 36). Expenses incurred traveling to and from the wilderness increased significantly, particularly for day-users. Expenses associated with the trip, such as licenses, film, food, and equipment, increased, although the increase was significant only for day-users. Travel expenses were greater than other expenses for day-users but less than other expenses for overnight visitors. In 1972, total expenses were higher for overnight visitors, while in 1990, day-users spent more.

Summary of Visit Characteristics—There were few substantial changes in visit characteristics between 1972 and 1990. No group characteristics changed significantly for either day-users or overnight visitors. Some changes in activity participation occurred, most notably a decline in the proportion of overnight visitors that fished. Trip characteristics

Table 35—Trip characteristics of overnight visitors, Desolation Wilderness, 1972 and 1990.

Trip characteristic	1972	1990	Significance
Mean length of stay (nights)	2.9	2.3	<0.001
Mean number of campsites (number)	2.0	1.8	.02
Mean distance traveled (miles)	15	17	.001
Mean off-trail travel (miles)	1.8	2.7	.15

Table 36—Trip expenditures, Desolation Wilderness visitors, 1972 and 1990.

Expense category	Day-users			Overnight visitors		
	1972	1990	Significance	1972	1990	Significance
-----1990 dollars-----						
Expenses incurred traveling to and from the wilderness	30	116	<0.001	39	56	0.003
All other expenses	12	29	<.001	61	64	.66

of overnight visits changed the most. In 1990, fewer groups stayed out for more than a couple of nights, but the mean travel distance increased.

Wilderness Conditions and Evaluations of Those Conditions

This group of variables describes reported numbers of encounters with other groups and visitors opinions about a wide variety of conditions they encountered on their trips. Visitors were asked how many other groups they encountered and how they felt about that number of encounters. Visitors could respond that they "did not care" how many other people they saw or they could respond to a five-point scale from "saw way too few" to "saw way too many" people. They were also asked to evaluate wilderness conditions in terms of the amount of littering and the amount of "wear and tear (erosion and loss of vegetation)." For each question, responses were on a five-point scale from "very good" conditions to "very poor" conditions. Finally, visitors were asked how satisfied they were with their trips. Again, responses were on a five-point scale from a "very good" trip to a "very poor" trip.

For a few variables, permit-holders' responses and the entire visitor population differed significantly in

1990 (table 26). For these variables, extrapolation of results to all visitors should be done cautiously. Among day-users, permit-holders were more likely to "not care" how many other people they saw. They also reported more encounters with other groups than the entire population of day-users. Among overnight visitors, permit-holders thought that wilderness conditions, in terms of "wear and tear," were worse than the larger population did.

Wilderness Condition Trends for Day-Users—

The number of groups that day-users typically encountered did not change significantly between 1972 and 1990; means were between eight and nine groups per day each year (table 37). The proportion of day-users in our sample who did not care how many people they met increased from 6 to 15 percent and the proportion who saw too many declined (table 38). Although neither change was statistically significant, these results suggest that day-users are quite tolerant and perhaps becoming even more tolerant of numerous encounters with other groups. Condition ratings in terms of litter were generally good in both years, with the proportion of good and very good ratings increasing significantly over the period (table 39). Visitor evaluations of wear and tear to soil and vegetation also suggested that they thought conditions

Table 37—Social conditions encountered by visitors to Desolation Wilderness, 1972 and 1990.

Social condition variable	Day-users			Overnight visitors		
	1972	1990	Significance	1972	1990	Significance
Mean number of other groups seen per day	8.1	8.5	0.81	3.8	4.0	0.49
Mean number of large groups ¹ seen per day	.36	.34	.79	.32	.18	.003
Mean number of groups camped within sight and sound	—	—	—	1.4	1.0	.50
Ability to find desired campsite solitude:						
Every night (percent)				42	43	
Some nights (percent)				46	49	
Never (percent)				13	9	
				$\chi^2, p = 0.45$		

¹Large groups were those with at least 11 members.

Table 38—Visitor opinions about number of other people seen, Desolation Wilderness, 1972 and 1990.

Visitor opinion	Day-users			Overnight visitors		
	1972	1990	Significance	1972	1990	Significance
Percent who did not care how many people they saw	6	15	0.06	5	4	0.93
Of those who did care, percent who saw too many	33	22	.14	55	39	<.001

Table 39—Visitor opinions about litter, Desolation Wilderness, 1972 and 1990.¹

	Litter condition					Mean condition
	Very poor				Very good	
	1	2	3	4	5	
----- Percent of visitors -----						
Day-users						
1972	2	17	23	21	38	3.8
1990	0	5	17	35	41	4.1
Significance						.04
Overnight visitors						
1972	10	16	28	28	18	3.3
1990	4	13	17	35	30	3.7
Significance						<.001

¹Condition was rated on a scale of 1 (very poor) to 5 (very good), with 3.0 indicating fair condition.

were generally good—both in 1972 and in 1990 (table 40). Overall trip ratings were very high, with most day-users selecting the highest rating in each year (table 41). The proportion of very good ratings increased significantly over the period.

Wilderness Condition Trends for Overnight Visitors—No significant changes in either the total number of groups encountered or the number of groups camped within sight and sound were found (table 37). The ability to find one's preferred level of campsite

solitude was also unchanged. The mean number of large groups encountered did decline significantly. In 1972, about one encounter in 12 was with a group larger than 10; in 1990, only one encounter in 22 was with such a large group. In both years, almost all visitors cared about the number of other people they saw, but there was a significant decrease in the proportion that felt they had seen too many (table 38). This trend suggests that overnight visitors are becoming more tolerant of encounters, since the mean

Table 40—Visitor opinions about use impacts, Desolation Wilderness, 1972 and 1990.¹

	Wear and tear condition					Mean condition
	Very poor				Very good	
	1	2	3	4	5	
----- Percent of visitors -----						
Day-users						
1972	0	8	24	33	35	4.0
1990	0	2	17	45	35	4.1
Significance						.22
Overnight visitors						
1972	4	9	32	35	19	3.6
1990	2	6	32	40	21	3.7
Significance						.08

¹Condition was rated on a scale of 1 (very poor) to 5 (very good), with 3.0 indicating fair condition.

Table 41—Visitor opinions about trip quality, Desolation Wilderness, 1972 and 1990.¹

	Trip quality					Mean rating
	Very poor 1	2	3	4	Very good 5	
----- Percent of visitors -----						
Day-users						
1972	0	4	6	37	54	4.4
1990	0	0	2	29	69	4.7
Significance						.02
Overnight visitors						
1972	0	2	7	37	54	4.4
1990	0	1	7	31	60	4.5
Significance						.19

¹Trip quality was rated on a scale of 1 (very poor) to 5 (very good), with 3.0 indicating fair quality.

number of encounters increased slightly in the 1990 sample.

As with day-users, most overnight visitors felt that litter conditions were fairly good and ratings improved over the period (table 39). Overnight visitors also felt that conditions related to “wear and tear” were fairly good, with ratings not significantly different in 1972 and 1990 (table 40). Overall trip ratings were very high but not significantly different between years (table 41).

Differences Between Day-Users and Overnight Visitors—In both years, day-users encountered more groups per day than overnight visitors; however, fewer day-users felt that they saw too many people. This suggests that day-users were more tolerant of encounters than overnight visitors in both years. Encounters with large groups declined for overnight visitors so that encounters were less common for overnight visitors than day-users in 1990. The proportion of day-users who did not care how many people they met increased so that 1990 day-users were more likely to not care how many people they met. In both years, day-users tended to consider the Desolation to be in better condition in terms of both litter and “wear and tear” to vegetation and soil. Overall trip ratings were similar each year. None of this suggests very different trends between day-users and overnight visitors.

Summary of Wilderness Condition Variables—Few dramatic changes in visitors’ opinions of wilderness conditions occurred. Ratings for numbers of people, litter, and “wear and tear” generally improved between 1972 and 1990, as did overall trip ratings. While many of these changes were statistically significant, few were sizeable. Only the opinions of overnight visitors about numbers of people changed greatly; there was a pronounced decline in the proportion of

visitors who felt they had seen too many people, despite the fact that they saw at least as many people as 1972 visitors. The social conditions that visitors report encountering also did not change greatly, with the exception of a major decrease in the frequency which overnight visitors encounter large groups.

Visitor Preferences for Social Conditions and Management

This group of variables is concerned with preferences for conditions and management—as opposed to evaluations of current conditions. Visitors were asked to imagine various levels of encounters that they might have on the trail or at their campsites and to estimate how satisfied they would be if they actually encountered that number of groups. Possible ratings ranged from 100 percent satisfaction to 0 percent satisfaction. They were also asked their preferred level of campsite solitude—the number of other groups they like to have camped within sight and sound. Finally, visitors were asked about the desirability of various levels of facility development and management actions. Responses were expressed on a five-point scale from “very undesirable” to “very desirable.”

For these variables, there was little difference between the responses of permit-holders and those of the entire visitor population (table 26). No significant differences among day-users were recorded. Among overnight visitors, permit-holders preferred lower campsite encounter levels and were less likely to consider rock firerings to be desirable.

Social Condition Preferences for Day-Users—Day-users were asked how they would feel about encountering various numbers of average-sized backpacking parties on a three-day trip and about camping within sight or sound of various numbers

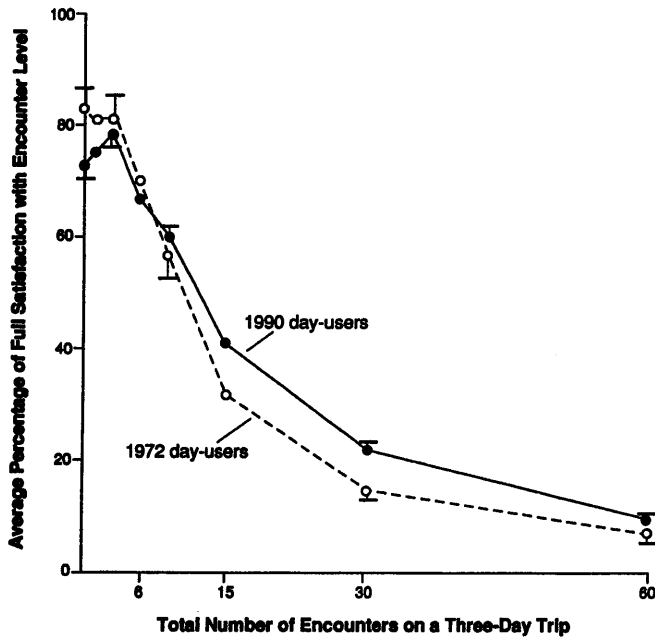


Figure 6—Reported satisfaction of day-users in relation to total encounters, Desolation Wilderness, 1972 and 1990. Bars indicate 1 standard error.

of other groups. Both of these situations require the day-user to imagine an overnight trip. Day-users in 1990 reported lower satisfaction level estimates than they did in 1972 for their probable response to meeting

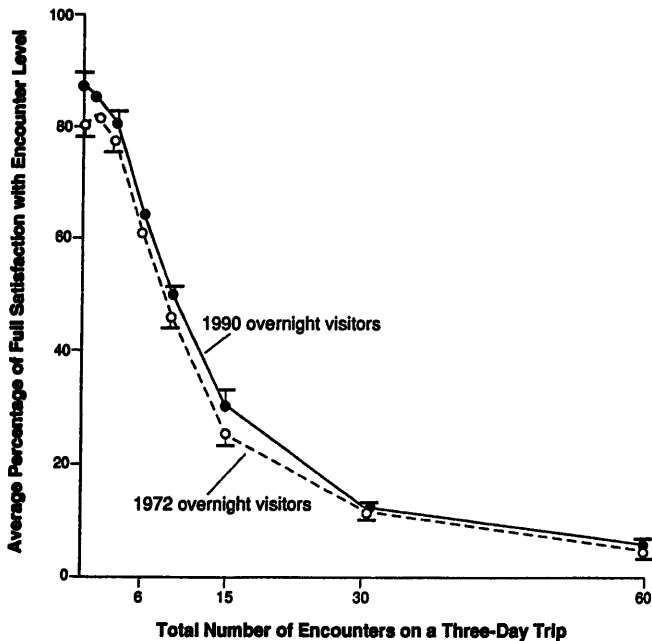


Figure 7—Reported satisfaction of overnight visitors in relation to total encounters, Desolation Wilderness, 1972 and 1990. Bars indicate 1 standard error.

0-6 other groups on a three-day trip; however, they reported higher satisfaction estimates for meeting 9-60 other groups (fig. 6). In both years, satisfaction estimates generally declined with increasing numbers of encounters, but the rate of satisfaction loss with increasing encounters appears to have declined somewhat over time. We tested the statistical significance of this apparent trend by approximating the data with regression equations and by testing whether the resultant regression lines had different slopes or intercepts. The slope of the regression line for 1990 day-users was significantly less steep than the slope of the line for 1972 day-users, suggesting an increase in tolerance of total encounters over the period. Day-users in 1990 reported higher satisfaction level estimates than 1972 day-users for their probable response to the entire range of campsite encounters, from 0 to 10 other groups. The intercepts of the regression lines differed, but the slopes did not. This finding suggests that 1990 day-users were generally more satisfied than 1972 day-users, but the relationship between these satisfaction estimates and the number of encounters was unchanged over the period.

Social Condition Preferences of Overnight Visitors—In 1990, overnight visitors reported higher satisfaction level estimates than they did in 1972 for their probable response to the entire range of total encounters (fig. 7). Overnight visitors in 1990 also reported higher satisfaction level estimates with the entire range of campsite encounter levels (fig. 8). In

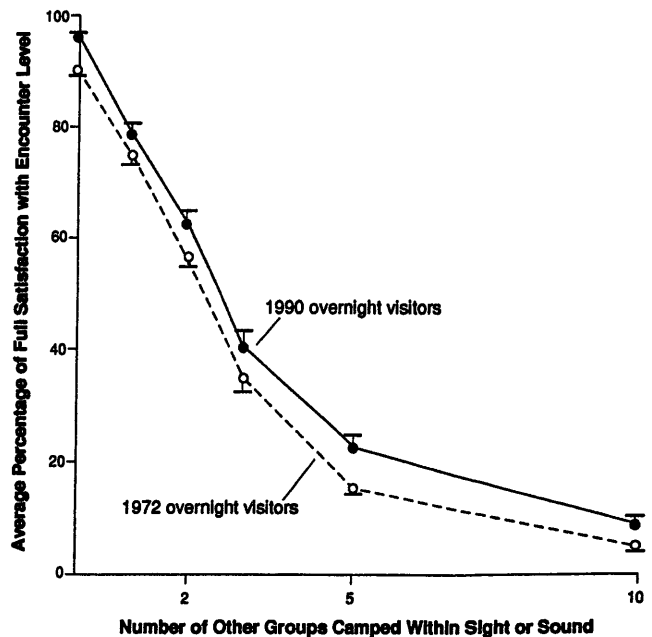


Figure 8—Reported satisfaction of overnight visitors in relation to campsite encounters, Desolation Wilderness, 1972 and 1990. Bars indicate 1 standard error.

Table 42—Visitor preferences about the number of groups camped within sight or sound, Desolation Wilderness, 1972 and 1990.

	Number of camping groups				Mean number of groups
	0	1	2	>2	
---- Percent of visitors ----					
1972	61	12	18	9	0.9
1990	69	14	11	6	.6
Significance					.01

both cases, regression analysis indicated that intercepts were different, but slopes were not. This suggests that the relationship between satisfaction estimates and number of encounters has not changed over the period, despite a general increase in satisfaction levels.

In contrast to this finding, we found that 1990 overnight users preferred fewer other groups camped within sight or sound than 1972 visitors did (table 42). The proportion of overnight visitors who prefer no other groups camped nearby increased from 61 percent in 1972 to 69 percent in 1990. The mean declined from 0.9 groups in 1972 to 0.6 groups in 1990.

Summary of Social Condition Preferences—No dramatic changes in visitor preferences with regard to levels of intergroup contact occurred. In 1972, most visitors preferred camping with no other groups

within sight or sound. This preference for high levels of campsite solitude increased somewhat over the period. The relationship between satisfaction estimates and number of campsite encounters was unchanged, for both day-users and overnight visitors. The relationship between satisfaction estimates and total encounters was also unchanged for overnight visitors. For day-users, however, the rate of satisfaction loss with increasing total encounters declined over the period. In 1972, this relationship was similar for both day-users and overnight visitors. In 1990, day-users appeared to be more tolerant of large numbers of encounters than overnight visitors.

Managerial Preferences for Day-Users—Day-user opinions about the desirability of facilities and management actions were relatively unchanged over the period (table 43). Facilities and management

Table 43—Visitor opinions about the desirability of facilities and management actions, Desolation Wilderness, 1972 and 1990.¹

Facility/management action	Day-users			Overnight visitors		
	1972	1990	Significance	1972	1990	Significance
High-standard trails	2.4	3.0	<0.001	2.2	2.8	<0.001
Low-standard trails	4.0	3.6	<.01	4.0	3.6	<.001
Some areas without trails	4.2	3.6	<.001	4.2	4.1	.26
Leaving 1-2 trees per mile across trail	3.2	3.0	.06	3.3	3.0	<.01
Bridges over creeks	2.7	3.3	<.001	2.4	2.9	<.001
Bridges over rivers	3.9	4.4	<.01	3.9	4.1	.05
Outhouses	2.8	3.0	.29	2.0	2.0	.86
Cemented fireplaces	2.3	2.5	.17	1.8	1.6	.15
Small firerings	3.6	3.3	.02	3.2	2.8	<.01
Interpretive signs	3.1	3.4	.06	2.8	2.5	.06
Natural lightning fires	2.5	3.0	.02	2.5	3.2	<.001
Natural fishery—no stocking	2.7	2.7	.75	2.6	2.6	.66
Using chain saws to clear trail	3.0	3.2	.34	2.5	3.0	<.001
Packing unburnable garbage out	4.5	4.7	.11	4.8	4.9	<.01
Prohibiting wood fires where wood is scarce	3.9	4.0	.53	3.7	4.1	<.001
Limiting use if area is overused	4.2	4.4	.27	4.5	4.5	.56
Requiring use of assigned campsites	2.1	2.4	.05	1.8	1.8	.49

¹Desirability is expressed on a scale of 1 (very undesirable) to 5 (very desirable), with 3.0 indicating a neutral response.

actions that were unfavored or favored in 1972 remained unfavored or favored in 1990. Subtle shifts are apparent, however. Support for high standard trails, bridges over creeks, and bridges over rivers increased significantly, while support for low standard trails and leaving some areas without trails decreased. This suggests increased interest in a more convenient trail system. More "purist" attitudes were apparent in decreased support for small firerings (campfires were prohibited in 1990) and increased support for natural forest fires that are started by lightning. Support for requiring visitors to camp each night in an area assigned to them also increased significantly, but remained the least desirable action suggested.

Managerial Preferences for Overnight Visitors—Overnight visitor opinions about facilities and management actions also shifted subtly over the period (table 43). Support for high standard trails, bridges over creeks, bridges over rivers, and administrative use of chain saws to clear trails increased significantly, while support for low standard trails and leaving a few trees blown down across the trail decreased. Support for prohibiting fire where wood is scarce increased, while support for small firerings decreased. This finding suggests general support for the prohibition on campfires that was initiated in 1990. The desirability of packing unburnable garbage out of the wilderness increased further, despite being the most desirable item on the list in 1972. The most substantial change was the increase in desirability of natural forest fires started by lightning.

Overnight visitors were also asked about the desirability of limiting group size. This action was supported by about three-quarters of visitors, both in 1972 and in 1990 (table 44). The mean suggested group size limit increased from 9.5 in the 1972 sample to 10.2 in the 1990 sample. This increase was not statistically significant, and the median suggested

limit was 8 people each year. Support for a very low limit (<6 people per group) declined over the period.

Summary of Managerial Preferences—Preferences for facilities and management actions shifted subtly between 1972 and 1990. Trends were similar for both day-users and overnight visitors. The most prominent trend was increased support for construction and maintenance of a transportation system that was comfortable and convenient for the user. The mean desirability of trails that were "fairly straight with wide, steady grades," bridges over creeks "where hikers would otherwise get their feet wet," and use of chain saws remained in the neutral category in 1990, but support clearly grew over the period. At the same time, support for trails that are "narrow, with variable grades, winding, and not the shortest route," leaving a few trees blown down across the trail, and leaving some areas with no trail all declined.

Opinions about management actions were more stable, although there were a few significant changes. Where opinions did change, support for management actions needed to preserve wilderness character increased. Most notable was a sizeable increase in support for fire management programs that would allow fire to play a more natural role in the ecosystem. In stark contrast, support for maintaining a natural fishery (no stocking and leaving barren lakes barren) remained low, despite the fact that the proportion of visitors that fish has declined.

Conclusions

The following principal conclusions can be drawn about trends in visitors to Desolation Wilderness between 1972 and 1990:

1. Visitor characteristics changed more than characteristics of the wilderness visit, visitor evaluations of wilderness conditions, or visitor preferences about social conditions, facilities, and management actions.

Table 44—Opinions of overnight visitors about group size limits, Desolation Wilderness, 1972 and 1990.

Visitor opinion	1972	1990	Significance
Percent who think group size should be limited	75	76	0.90
Percent who think maximum group size should be:			
1-5 people	22	13	
6-10 people	59	64	
11-15 people	10	16	
16-20 people	4	3	
>20 people	5	5	
Mean suggested group size limit	9.5	10.2	.39
Median suggested group size limit	8	8	

2. The proportion of visitors who are male, students, and conservation organization members declined, while age and income increased for overnight visitors. In general, 1990 Desolation Wilderness visitors were more similar to those of the general population than 1972 visitors were. Differences between day-users and overnight visitors also declined.

3. The previous wilderness experience of overnight visitors increased between 1972 and 1990, accentuating the greater experience levels of overnight visitors in relation to day-users.

4. Visit characteristics—the types of groups that visit wilderness and the types of trips that they take—were relatively unchanged. The mean length of overnight stay declined slightly from 2.9 nights in 1972 to 2.3 nights in 1990.

5. Levels of interparty contact were similar in 1972 and in 1990, except for a decline in the frequency with which overnight visitors encountered large groups. There was some evidence, for both day-users and overnight visitors, that tolerance of frequent encounters has increased. The proportion of overnight visitors saying they saw “too many people” declined substantially. There also was a decline in the rate of satisfaction loss that day-users estimated would occur if they experienced increasing numbers of encounters. However, several other variables suggest little change in tolerance. The 1990 visitors preferred even higher levels of campsite solitude than 1972 visitors.

6. Visitor evaluations of litter conditions, “wear and tear” to vegetation and soils, and overall trip quality were generally good and increased slightly.

7. The most prominent trend related to facilities and management was increased support for a more comfortable and convenient trails system. Support increased for high standard trails, bridges, and the use of chain saws to clear trails. Support decreased for low standard trails, leaving a few trees blown down across the trail, and leaving some areas without trails.

8. Trends in attitudes about management needed to maintain natural conditions in wilderness were mixed. Support for a more natural fire management policy increased greatly, but support for a more natural fishery remained weak.

Synthesis

Of necessity, this research has taken a case study approach. The existence of earlier surveys and availability of resources limited the number of wildernesses that could be included in this study. Nevertheless, our primary interest was to attempt to identify trends that might be widespread across the National Wilderness Preservation System. It is impossible to make

confident generalizations about overall wilderness trends from a small number of case studies; however, some of the changes identified are more likely to be general trends than others. This synthesis will attempt to evaluate which changes are most likely to be general trends. The reader should remember the risk of generalizing from changes in just a few wildernesses.

The general approach taken was to see if there were consistent trends across these individual case studies. The number of case studies to draw from was limited—the three case studies reported here, the Bob Marshall study (Lucas 1985), and the very limited results from Great Smoky Mountains National Park (Burde and Curran 1986). Each variable that was examined in more than one area was classified as follows: (1) significant difference between years; (2) difference between years that was not significant; or (3) no difference between years. To include more case studies, we included results from the Bob Marshall and Great Smoky Mountain studies. Our classification of variables from those two studies are presented in tables 45 and 46. Statistical significance could not be formally tested, but Lucas (1985) often presented confidence intervals. We used these confidence intervals and consideration of the magnitude of differences to classify variables.

Each variable was classified in terms of whether or not there was a statistically significant change (or substantial change in the Bob Marshall and Smoky Mountains), and whether the direction of change was consistent across the five case studies or varied from wilderness to wilderness. Categories were as follows:

- strong consistent trend (significant change in the same direction in at least three areas and no opposing trends);
- weakly consistent trend (change in the same direction in all areas but not significant in at least three areas);
- no change (no significant changes in either direction);
- strong inconsistent change (significant change in opposing directions or significant change in one direction and at least two areas with change in opposing direction); and
- weakly inconsistent change (significant change in one direction and nonsignificant change in opposing direction).

Strong Consistent Trends

Of 63 different variables that could be assessed in at least three different areas, only five exhibited a strong consistent trend (table 47). These changes are most likely to be consistent trends across the

Table 45—Trends in the Bob Marshall Wilderness Complex, categorized on the basis of magnitude of change (data from Lucas 1985).

Substantial changes:

Higher educational attainment; more females; fewer students; more first-time visitors to the Bob Marshall; more hiking groups; less hunting; better ratings for litter conditions; increased support for high-standard trails, bridges over creeks, bridges over rivers, natural lightning fires, packing out unburnable litter, and prohibiting campfires where wood is scarce; decreased support for leaving a few trees blown down across the trail.

Small changes:

Younger visitors; more conservation organization members; fewer previous visits to the Bob Marshall; fewer days spent in wilderness in past year; more solo visitors; smaller groups; fewer organized groups; less fishing; more hiking, photography, nature study, mountain climbing, and swimming; shorter overnight stays; more day-use; more campsites used; longer distance traveled; more summer use; less weekend use; less use of most popular trailheads; more total encounters per day; more difficulty providing desired level of campsite solitude; better overall trip rating; worse ratings for "wear and tear;" more support for leaving some areas trailless, small firerings, interpretive signs, and a natural fishery; less support for low-standard trails, outhouses, cement fireplaces, administrative use of chain saws, and assigning campsites; increase in preferred number of other groups camped within sight or sound.

No change:

Population of current residence; first-time wilderness visitors; age of first wilderness visit; number of wilderness visits in past year; family groups; proportion of off-trail travel; encounters with large groups per day; feelings about whether or not they saw too many people; support for limiting use if the area is overused.

National Wilderness Preservation System. Three of these changes were sociodemographic characteristics. Age of the typical wilderness visitor increased significantly in four of the five areas and was unchanged in the Bob Marshall. The proportion of females increased significantly in three of the five study areas, increased slightly at Great Smoky Mountains National Park, and was unchanged in the Boundary Waters. Educational attainment increased in all four areas where it was reported, although it was unchanged among Desolation day-users.

No group type, trip characteristic, or visitor preference variables clearly changed in a consistent direction. One wilderness experience variable and one wilderness condition evaluation exhibited a consistent trend. The proportion of visitors who had experience in wildernesses other than the one they were currently visiting increased in all three areas where this variable was assessed. Visitor evaluations of the severity

Table 46—Trends in Great Smoky Mountains National Park, categorized on the basis of magnitude of change (data from Burde and Curran 1986).

Substantial changes:

Older visitors; more solo visitors; more groups of friends.

Small changes:

More females; smaller groups.

No change:

Length of stay.

Table 47—Strength and consistency of trends across five wildernesses for 63 variables.

Strong consistent trends:

Older visitors; higher educational attainment; more females; more visitors who have been to other wildernesses; better ratings for litter conditions.

Weak consistent trends:

Increased income; fewer first-time wilderness visitors; visitors were older when they first visited wilderness; more solo visitors; smaller groups; fewer organized groups; shorter overnight stays; more day-use; less fishing; more mountain climbing; use more concentrated in summer; higher total encounter rates; less support for low-standard trails and leaving a few trees blown down across the trail; more support for high-standard trails, bridges over creeks, bridges over rivers, natural lightning fires, packing unburnable garbage out of the wilderness, prohibiting wood fires where dead wood is scarce, and limiting the size of visitor groups.

Variables that did not change:

Population of current residence; days spent in wilderness in the past year; proportion of visitors who hike, photograph, and swim; off-trail travel; number of campsite encounters; ability to find preferred level of campsite solitude; ratings of "wear and tear;" support for outhouses, cement fireplaces, interpretive signs, a natural fishery, and restricting use if area is overused.

Strong inconsistent changes:

Proportion of visitors who are students and members of conservation organizations; first-time visitors to the specific wilderness; number of previous visits to the specific wilderness; proportion of visitors who hunt and study nature; number of encounters with large groups; relationship between satisfaction estimates and hypothetical encounter rates.

Weak inconsistent changes:

Number of wilderness visits in the past year; typical frequency of wilderness visits; proportion of groups with family members; proportion of hiking groups; distance traveled; number of different campsites used; concentration of use on weekends; concentration of use at certain trailheads; overall trip quality ratings; visitor opinions about the number of other people they encountered; preferred campsite encounter rates; visitor support for trailless areas, firerings, assigning campsites, and administrative use of chain saws.

of problems with litter suggested improvement in all three areas where this was assessed.

Weak Consistent Trends

For 21 variables there was some evidence of a consistent trend, but not enough to be conclusive (table 47). Included in this category are variables that changed consistently but subtly, and variables for which data from only a couple of areas are available. Household income is the one sociodemographic variable in this category. Annual income increased significantly at Boundary Waters; it increased slightly among both day-users and overnight visitors at Desolation, but less so than in the general population.

Several wilderness experience variables exhibited a weak trend. The proportion of visitors making their first wilderness trip decreased significantly in Desolation and Boundary Waters, but was unchanged in the Bob Marshall. Along with the strong increase in the proportion of visitors who have visited other wildernesses, this suggests a trend of increased experience in wilderness generally—but not necessarily increased experience in the specific wilderness being studied. The age at which visitors first took a wilderness trip increased in two of the three areas in which it was assessed.

Eight of 20 visit characteristics exhibited weak trends. The proportion of solo visitors in our sample increased in all five areas. This increase was not significant in any of the areas where we could evaluate statistical significance, although the magnitude of the increase at Great Smoky Mountains suggests a statistically significant change. Nevertheless, the consistency of these results suggests that there may be a general trend toward more solo visitation. The median magnitude of change was a 30 percent increase in solo visitation. The proportion of visitors in our sample who came in organized groups declined in all three areas where this variable was assessed. Again, the declines were not significant, but the changes were consistently in the same direction, and the median magnitude of decline was about 50 percent.

It has been suggested that wilderness groups are getting smaller (Roggenbuck and Watson 1988). This study provides at least weak support for this statement. The mean size of groups in our sample declined in all five areas; however, the decline was statistically significant only at Shining Rock. Among these areas, the median decline in group size was 13 percent. In all areas other than Boundary Waters, the most common group size in each year was two. Despite this apparently consistent decline in mean group size, changes differed between areas (fig. 9). At Desolation and Shining Rock, the proportion of groups with one or two people increased while the proportion of larger groups declined. In the Boundary Waters, groups of

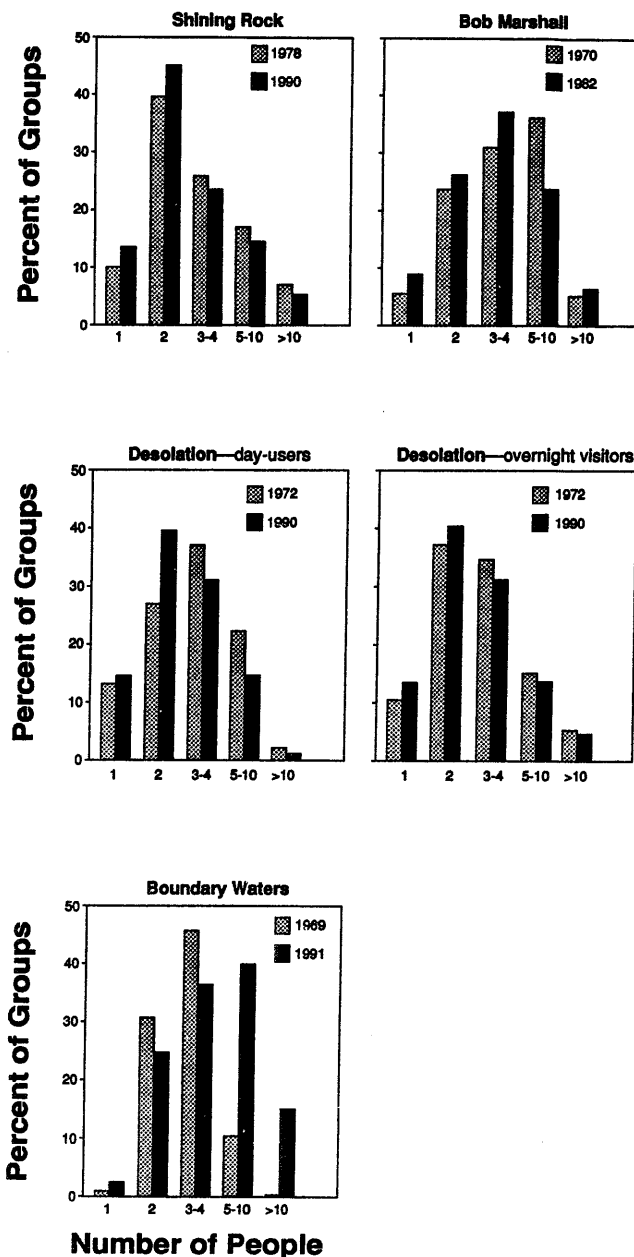


Figure 9—Group size of all visitors to Shining Rock Wilderness and the Bob Marshall Wilderness complex, day-users and overnight visitors to Desolation Wilderness, and overnight visitors to the Boundary Waters Canoe Area Wilderness.

five to ten people became more common, while groups smaller than five and larger than ten became less common. Boundary Waters instituted a group size limit of ten between 1969 and 1991. In the Bob Marshall, groups of five to ten became less common, while groups smaller than five became more common, as did groups larger than ten.

It has also been suggested that length of stay is getting shorter in wilderness (Roggenbuck and Watson 1988). Again, this study provides weak support for

this statement. Length of overnight stay decreased in four areas, with statistically significant decreases at Desolation and Shining Rock. Trip length was unchanged at Great Smoky Mountains. In all areas other than the Boundary Waters the most common length of stay was either one or two nights and did not change between years. The median decline in length of overnight stay was 13 percent. As with group size, changes differed between areas (fig. 10). At Shining Rock, stays of one night increased, while longer stays decreased. At Desolation, stays of one and two nights increased, while longer stays decreased. In the Boundary Waters, stays of three to five nights increased, while both shorter and longer stays decreased. Finally, in the Bob Marshall, no pattern of change is apparent other than a decrease in the proportion of stays longer than five nights.

The proportion of day-use was only assessed at Shining Rock and the Bob Marshall. It increased 44 percent at Shining Rock, but this estimate has questionable validity given the likelihood that day-users were underrepresented in the 1978 sample. In the one study that provides valid comparable results, day-use increased in the Bob Marshall from 20 percent of all visits in 1970 to 22 percent in 1982. About 75 percent of 1990 visits at Desolation were day-use trips; Lucas (1980) estimated that about 40 percent of 1974 visits were day-use. If his estimate was even moderately accurate, this would provide another example of a substantial increase in day-use.

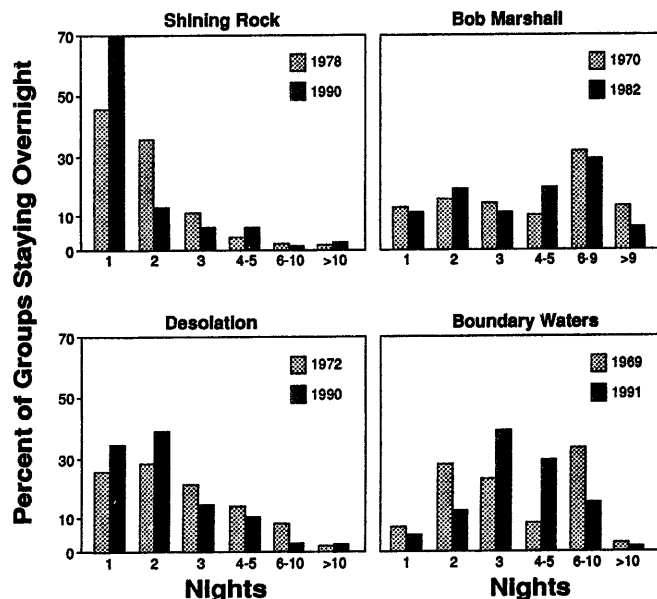


Figure 10—Overnight length of stay for visitors to Shining Rock Wilderness, the Bob Marshall Wilderness Complex, Desolation Wilderness, and the Boundary Waters Canoe Area Wilderness.

The proportion of visitors who fished decreased in both areas where fishing was assessed, while the proportion that climbed mountains increased. In both cases, changes were significant in only one area. Finally, much more use occurs in summer than in fall, and this concentration of use in the summer months increased in the two areas where this was assessed (median 12 percent increase).

The mean number of other groups encountered per day increased in all four areas, although none of these increases were significant. Increased encounters are suggestive of increased use, which clearly has occurred in all areas other than perhaps Shining Rock. Use may also have increased at Shining Rock, despite Forest Service use estimates to the contrary. Alternative explanations for higher encounter levels would be that use is more concentrated now than in the past or that current visitors expend less effort trying to avoid encounters.

Nine visitor preference variables exhibited at least a weak trend. Five of these relate to trail conditions and an apparent increase in support for a more comfortable and convenient trail system. In the two areas where these preferences were assessed, support for high standard trails, bridges across creeks (where feet would otherwise get wet), and bridges across rivers (that are dangerous to wade) increased significantly, while support for low standard trails and leaving a few trees blown down across the trail decreased. At Desolation, trends in the preferences of both day-users and overnight visitors were identical. Moreover, there was also some evidence that Shining Rock visitors were supportive of a more convenient trail system. The perceived severity of problems with trail maintenance and marking increased there.

Support for packing out unburnable garbage, for prohibiting wood fires where dead wood is scarce, and for limiting group size increased in the Desolation and the Bob Marshall. These behaviors and management actions were all supported by Desolation visitors in 1972, but only limits on group size were supported in the Bob Marshall in 1970. By 1982 in the Bob Marshall and 1990 in Desolation, all of these actions were generally supported. Finally, the desirability of natural forest fires started by lightning increased among day-users and overnight visitors at Desolation and all visitors to the Bob Marshall. This increased support for natural fire programs contrasts with the lack of support for a natural fishery.

Variables That Did Not Change

For 14 variables, there was no significant change in any area (table 47). Most of these variables were trip characteristics, wilderness condition evaluations, and visitor preferences. One sociodemographic variable—population of current residence—did not change

significantly in any of the three areas in which it was assessed. One wilderness experience variable—number of days spent in wilderness in the past year—did not change much anywhere.

In the Bob Marshall and Desolation (the only areas where activity participation was assessed), the proportion of visitors who hike, photograph, and swim was relatively unchanged, as was the typical distance that groups traveled off-trail. There were no significant changes in numbers of other groups encountered around campsites or in the ability of visitors to find the level of campsite solitude that they prefer. Visitor evaluations of amount of “wear and tear” (erosion and loss of vegetation) were also relatively unchanged.

Among visitor preferences, there was no significant change in support for outhouses, cemented fireplaces, or interpretive signs at Desolation or the Bob Marshall (the two areas where such preferences were assessed). Outhouses and cemented fireplaces were generally considered undesirable both times visitor preferences were assessed. Visitors were neutral about interpretive signs. There was no significant change in the desirability of a natural fishery, implying no fish stocking and leaving barren lakes alone. This notion was strongly rejected by Bob Marshall visitors and slightly rejected by Desolation visitors. Finally, there also was no significant change in support for restricting the number of visitors if the wilderness was being used beyond capacity. This action—already taken at Desolation—was strongly supported both years.

Strong Inconsistent Changes

Another eight variables changed significantly in individual wildernesses, but the direction of change varied from area to area (table 47). These variables are subject to change over time, but there is no simple trend across the wilderness system. Two of these variables are sociodemographic characteristics. The proportion of visitors who are students decreased significantly in three areas but increased significantly at Shining Rock. One potential explanation for this difference is that the baseline year for the three areas that increased was 1969-1972, while the baseline year at Shining Rock was 1978. Perhaps most of the decline in student participation took place between 1972 and 1978. Backpacking was probably more of a fad among students in the early 1970's. The proportion of visitors who are members of conservation organizations declined significantly at Desolation, increased significantly at the Boundary Waters, and increased insignificantly at the other two areas.

Two wilderness experience variables and two trip characteristics variables exhibited strong but inconsistent changes. First time visitors to the wildernesses under study increased significantly at the Bob Marshall and decreased at Desolation. The

number of previous visits to the area also decreased in some areas and increased in others. At Desolation, the number of previous visits decreased among day-users and increased among overnight visitors. The proportion of visitors who hunted on their trip increased significantly at Desolation and decreased in the Bob Marshall. Conversely, the proportion that participated in nature study decreased among Desolation overnight visitors and increased in the Bob Marshall.

Encounter rates with large groups changed in an inconsistent manner across wildernesses. They decreased at Desolation and the Boundary Waters, increased at Shining Rock, and stayed the same at the Bob Marshall. This difference reflects, in part, different definitions of a large group—more than six people at Shining Rock and more than ten people elsewhere. It also reflects the imposition of a party size limit of ten in the Boundary Waters. The proportion of groups larger than ten increased at the Bob Marshall and decreased elsewhere. Finally, inconsistent changes were found in visitor tolerance of encounters with other groups, as suggested by the relationship between satisfaction estimates and hypothetical number of encounters. Tolerance appears to have increased among Desolation day-users and Shining Rock visitors, to have decreased among Boundary Waters overnight visitors, and to have remained stable among Desolation overnight visitors.

Weak Inconsistent Changes

For 15 variables it is unclear whether the variables are relatively stable or are changing in inconsistent and subtle ways (table 47). The number of wilderness visits taken in the past year increased significantly among Desolation overnight visitors and all Shining Rock visitors; however, it decreased among Desolation day-users and was unchanged among Bob Marshall visitors. Typical wilderness visit frequencies also increased in some areas and decreased in others.

The proportion of groups that contain family members increased significantly at the Boundary Waters, but decreased in some other areas, including Great Smoky Mountains. Trip characteristics that were weakly inconsistent included the proportion of groups that hiked, distance traveled, and the number of separate campsites used. The proportion of use that occurs on weekends increased significantly at Shining Rock and decreased in the Bob Marshall. Similarly, the concentration of use at just a few trailheads increased significantly at Shining Rock and decreased in the Bob Marshall.

Overall trip ratings increased significantly only for Desolation day-users, and they decreased slightly for Shining Rock users. The proportion of visitors who felt they saw too many people or that the area was

overcrowded decreased significantly among Desolation overnight visitors, but at other places this proportion increased or stayed the same. Visitor preferences for number of other groups camped nearby decreased significantly at Desolation but increased in the Bob Marshall. Finally, trends in visitor support were mixed for leaving some areas without trails, rock firings, assigning campsites, and administrative use of chain saws.

Conclusions

Only five of 63 variables (8 percent) exhibited a strong consistent trend, while another eight variables (13 percent) exhibited strong changes that differed between areas (table 48). Most of those variables that clearly changed were visitor characteristics. Four of 15 visitor characteristics (27 percent) exhibited a strong consistent trend, and another four exhibited strong inconsistent changes. Sociodemographic characteristics changed in particular, although wilderness experience variables also changed more often than other variables.

Much of the interest in visitor trends has focused on wilderness visit characteristics—both the types of groups that come to wilderness and characteristics of the wilderness trip, such as group size and length of stay. Few visit characteristics changed substantially, although for 40 percent of visit characteristics there was some evidence of a subtle trend. Wilderness conditions and visitor evaluations of those conditions was the variable category that most frequently exhibited no change. The only clear trend was an improvement in visitor evaluations of litter conditions.

Finally, visitor preferences were not highly changeable (table 48). For 45 percent of preference variables, however, there was weak evidence of a trend. Many of these were classified this way simply because they were only examined in two areas. There may be a strong trend toward more support for a high standard, convenient trail system, as well as more support for natural fire in wilderness. Trends for evaluations of

visitor crowding and preferences for amount of inter-party contact were inconsistent to the extent that they changed.

It is also possible to evaluate which wildernesses exhibited the most significant changes. These results should be treated cautiously because the variables assessed differed somewhat between areas, and the different sample sizes influenced the power of tests. In the case of the Bob Marshall, it was not even possible to assess significance statistically. Despite these caveats, Boundary Waters overnight visitors most often changed significantly, followed by Desolation overnight visitors and Shining Rock visitors. Desolation day-users and Bob Marshall visitors changed least frequently.

Three factors appear likely to have influenced how much change has occurred: the proportion of overnight use; the period of time over which trends were studied; and whether a pronounced shift in type of trip occurred. At Desolation, where overnight and day-users were independently surveyed, overnight visitors changed much more than day-users. Perhaps the characteristics of overnight visitors and their visits are more changeable. At the Boundary Waters—where frequency of change was greatest—the period of study was lengthy (22 years), and there was a dramatic shift from 40 percent motorized use in 1969 to only 10 percent motorized use in 1991. At Desolation, the period of study was long (18 years), but there was no shift in method of travel. At Shining Rock, the period of study was shorter—only 12 years—but an increase in day-use probably occurred. Finally, the period of study at the Bob Marshall was only 12 years, but a pronounced shift in method of travel occurred. It is tempting to speculate that the fact that there was more change at Desolation and Shining Rock than in the Bob Marshall suggests that the length of the period of study is more influential than a shift in type of trip and that a shift in the proportion of day-use is more influential than a shift in method of travel. More research would be needed to test any of these hypotheses.

Table 48—Strength and consistency between areas of changes in visitor characteristics, visit characteristics, conditions and evaluations, and visitor preferences.¹

Variable category	Response					Number of variables
	Strong consistent	Weak consistent	No change	Strong inconsistent	Weak inconsistent	
	<i>n</i> = 5	<i>n</i> = 21	<i>n</i> = 14	<i>n</i> = 8	<i>n</i> = 15	
Visitor characteristics	27	20	13	27	13	15
Visit characteristics	0	40	20	10	30	20
Conditions and evaluations	13	13	38	13	25	8
Visitor preferences	0	45	25	5	25	20

¹Values are the percent of all variables in each category that exhibited each response.

Conclusions

Few Clear, Consistent Trends—Few variables changed substantially and consistently across all study areas. Some variables, such as previous experience in the area and participation in hunting, increased in some wildernesses and decreased in others. This finding suggests that every area is unique and that it is dangerous to generalize about trends across the entire wilderness system. Studies that report results for one wilderness at one point in time are of limited value beyond that wilderness. This conclusion is emphasized by the number of trends identified by Lucas (1985) in the Bob Marshall that were not found in the other wildernesses we studied.

Visitor Characteristics Changed Most—The kinds of people who visit wilderness changed more than the types of trips they took, their evaluations of the conditions they encountered, or their preferences for conditions or management. Current wilderness visitors are generally older and more highly educated than earlier visitors were. In addition, a greater proportion of current visitors are females and have visited wildernesses other than the specific wilderness being studied. Experience in the specific wilderness and the proportion of visitors who are students also tended to change substantially, but the direction of these changes varied between wildernesses.

Overnight Visits Have Changed More Than Day Visits—At the Desolation Wilderness, overnight visits changed more than day visits. Visitor characteristics, visit characteristics, and evaluations of wilderness conditions all changed more frequently among overnight visitors than day-users. Visitor preferences were equally likely to change among overnight visitors and day-users.

Typical Wilderness Visits Are Relatively Unchanged—There is some evidence that solo visitors are more common and organized groups are less common, that groups are smaller and stays are shorter. However, all these changes are subtle at best. Groups have always tended to be small, and stays have tended to be short. The most common group size during the first year of study—two to four people, depending on the area—remained the same in all areas. The most common length of overnight stay—one night at Shining Rock and two nights elsewhere—remained most common, except at Boundary Waters where the most common length of stay increased to three nights. There may, however, be a large number of wildernesses—like Shining Rock and probably Desolation—where there has been a substantial increase in amount of day-use.

Less Litter—As Lucas (1985) reported for the Bob Marshall, current wilderness visitors consistently

feel that litter is a less severe problem than their predecessors did. This probably reflects a real reduction in litter, resulting from an effective campaign to convince visitors to pack out their garbage. Virtually everyone supports this policy in all wildernesses surveyed.

No Clear Trends in Tolerance of Interparty Contact—There is no clear evidence that today's wilderness visitors are any more or less tolerant of encounters with other groups than their predecessors. A majority of today's visitors prefer no other groups camped within sight and sound, as their predecessors did. Trends in attitudes about encounters away from the campsite are more divergent. Current Shining Rock visitors felt that "too many people" was less of a problem than their predecessors did, despite encountering more people. They were less likely to think that controls were needed for use. Reported satisfaction also decreased more slowly, with increasing numbers of encounters, in 1990 than in 1978. All these results suggest an increased tolerance for frequent interparty encounters.

At Desolation, the tolerance of day-users was higher than that of overnight visitors; moreover, the tolerance of day-users increased over time, while the tolerance of overnight visitors was unchanged. These differences between day and overnight visitors suggest that the increased tolerance of Shining Rock visitors may simply reflect an increase in day-use in that area. Finally, the tolerance of Boundary Waters visitors decreased over time. Current visitors are more likely to consider the area crowded, despite no significant change in number of encounters. Moreover, reported satisfaction declined much more rapidly with increasing numbers of encounters in 1991 than in 1969.

No Clear Change in the Impact Potential of Groups—On the basis of his Bob Marshall trend study, Lucas (1985) came to the optimistic conclusion that user characteristics had shifted toward a lower potential for resource impacts. Results from Desolation, Boundary Waters, and Shining Rock are less optimistic. Use concentration remains very high in these wildernesses, and trip and group characteristics remain largely unchanged. There is some evidence, however, of widespread adoption of at least the most rudimentary low-impact practices, particularly using stoves and packing out litter. The pronounced shifts in impact potential observed in the Bob Marshall reflect the shift away from horse trips, outfitted trips, and hunting—trip characteristics that are prevalent in only a few wildernesses around the country.

No Clear Shift From Consumptive to Contemplate Activities—Lucas (1985) also found a shift from more consumptive activities (hunting

and fishing) to more contemplative activities (photography, nature study, hiking) in the Bob Marshall. No similar pattern was evident in the Desolation, where trends in activity participation were assessed. Fishing decreased, but hunting increased. Among overnight visitors, hiking and nature study decreased, while photography was unchanged.

Trends in Attitudes About Natural Ecosystems Are Inconsistent—In the Bob Marshall and Desolation, visitors were asked about the desirability of two attributes of natural wilderness ecosystems—natural lightning fires and natural fisheries (no stocking and leaving barren lakes alone). Many wilderness areas are currently grappling with these management issues. Visitor attitudes and trends related to these two issues were remarkably consistent between the two areas. In the baseline study year, both natural lightning fires and a natural fishery were considered undesirable by two to three times as many people as considered them desirable. This high level of rejection of a natural fishery was maintained in the follow-up study in both wildernesses. In contrast, attitudes about natural fire changed dramatically. In both areas, the follow-up survey revealed more support for natural fire than rejection. This suggests that visitors will support the goal of preserving natural conditions in wilderness, but only, perhaps, when this does not disrupt their preferred activities. Forty to sixty percent of overnight visitors to these wildernesses fished during their trip.

Purist Attitudes About Trails Are Also Declining—In both Desolation and the Bob Marshall, support for high standard trails and bridges over creeks (where bridges are needed only to keep feet from getting wet) increased, while support for low standard trails and leaving a few trees blown down across the trail decreased. Support for administrative use of chain saws to clear trails also increased at Desolation. Meanwhile, at Shining Rock, there were significant increases in concern about poor trail maintenance, poor trail marking, and inadequate information about trail locations. Perhaps conditions actually changed there or perhaps visitors are increasingly interested in higher levels of trail maintenance, more trail markings, and more information on trail locations. All of these suggest a reduction in self-reliance and more interest in easy access and travel inside wilderness.

Overall Ratings of Trip Quality Remain Very High—The vast majority of visitors to all these areas were very satisfied with their trip or rated its quality as being very good. This did not change significantly over the years, except among Desolation day-users, for whom quality ratings increased.

Management Implications

The relatively small number of variables that changed consistently across these different wildernesses illustrates the danger of extrapolating results from one wilderness to another. Although horse use may decrease dramatically in a wilderness like the Bob Marshall, it may increase in a different wilderness. For the purpose of developing the information needed to manage an individual wilderness, it will then be necessary for many different wildernesses to study trends in their visitors. It may be possible, however, to identify groups of wildernesses for which trends are likely to be relatively similar. For example, many heavily used, mountainous wildernesses close to large urban areas with universities might change in similar ways.

One implication of this study stems from the findings that day-users are often very different from overnight users and that day-use is increasing at least in some areas. Day-users have seldom been studied; they seldom are monitored; and their use is frequently uncontrolled. Managers of wildernesses with substantial amounts of day-use would be wise to pay more attention to these users and their impacts.

Another implication stems from the finding that visitor characteristics changed more than visit characteristics or visitor preferences. The sociodemographic characteristics of people who come to wilderness have changed substantially, without a pronounced shift in the kinds of trips that visitors take or in their preferences for the conditions they encounter. Even though today's visitors are more likely than their predecessors to be older, women and not students, their preferences for conditions and the types of management actions they support are similar to their predecessors. This finding can be partially explained as changes in the sociodemographic characteristics of visitors who keep coming to wilderness. For example, visitors in 1972 who keep returning to Desolation would be older in 1990 and less likely to be students. Alternatively, this finding might suggest that wilderness visit characteristics and visitor attitudes and management preferences can remain stable despite pronounced shifts in the kinds of people who visit wilderness (such as more women). If the latter were the case, this would suggest less need for managers to worry about the sociodemographic shifts that have been predicted for the future. More research is needed.

The finding that wilderness visitors are now much more likely to have visited many different wildernesses suggests that visitors should have been exposed to a wider range of wilderness conditions and management practices. This should provide both new opportunities and new challenges to wilderness managers. If managers can be more consistent in their

management, visitors are more likely to respond in a positive way to programs. Long-term, cumulative exposure to consistent, educational messages and good management should gradually lead to better behavior. However, current visitors may be more likely to question management programs that are inconsistent with their prior experience and likely to be critical of actions they feel are unnecessary or unwarranted.

Little evidence exists that visitor tolerance of deteriorating conditions has increased greatly over time. Researchers have postulated that this would occur as less tolerant visitors are displaced to areas that are more to their liking (Clark and others 1971). In the Boundary Waters, the most frequently visited wilderness in the country, tolerance for interparty contacts actually declined from 1969 to 1991, as use levels increased. Tolerance of interparty contacts was unchanged for Desolation overnight visitors and for all Bob Marshall visitors. Only among Desolation day-users and Shining Rock visitors was there evidence of increased tolerance. This does not mean that displacement did not occur and is not a problem; however, it does suggest that tomorrow's visitors may be just as sensitive to problems as today's visitor is.

A less optimistic implication is the apparent lack of support for actions taken to restore natural conditions when they interfere with preferred activities (no longer stocking fishless lakes), and the increased interest in a more comfortable and convenient transportation system in wilderness. These attitudes are at odds with some agency policies that stress preservation of natural conditions and self-reliance. Either wilderness management policies should be reevaluated or managers should do a better job of convincing the public about the importance of these policies.

The high education levels of wilderness users continue to suggest their ability to comprehend complex educational messages. Education has apparently been effective in reducing problems with litter and in increasing use of stoves. Managers might consider developing educational campaigns that require more complex decisionmaking (such as campsite selection). They might also consider tackling issues such as fish stocking of barren lakes and appropriate levels of facility development (including trails in wilderness).

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Changes in wilderness visitors were studied over 12- to 21-year periods in the Boundary Waters Canoe Area, MN, Shining Rock, NC, and Desolation, CA. Only five of the 83 variables assessed changed consistently in all wildernesses. Visitor age and educational attainment increased, as did the proportion of visitors who were female and who had been to other wildernesses. Visitor evaluations of litter in the wilderness also improved. Typical wilderness visits were relatively unchanged, as were visitor preferences for wilderness conditions and management.

Keywords: recreation use, satisfaction, trends, visitor attitudes, visitor characteristics, wilderness



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