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RESEARCH

Perceived Effects of Setting Attributes on Visitor Experiences in Wilderness: Variation with Situational Context and Visitor Characteristics

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Abstract Understanding how setting attributes influence the nature of the visitor experience is crucial to effective recreation management. Highly influential attributes are useful indicators to monitor within a planning framework, such as Limits of Acceptable Change. This study sought to identify the setting attributes perceived to have the most profound effect on the ability to have "a real wilderness experience" and to assess the degree to which attribute importance varied with situational context and visitor characteristics. To this end, exiting hikers were surveyed at moderate and very high use trailheads in Alpine Lakes Wilderness, WA (USA), and Three Sisters Wilderness, OR (USA). They were asked about the degree to which encountering varying levels of different setting attributes would add to or detract from their experience. Attributes with the largest range of effect on experience, based on evaluations of different levels, were considered most important. The most influential attributes were litter and several types of campsite interaction—people walking through camp and number of other groups camping close by. The perceived importance of setting attributes did not vary much between wilderness locations with substantially different use levels, suggesting that conclusions are robust and generalizable across wilderness areas. There also was little difference in the perceptions of day and overnight visitors. In contrast, we found substantial variation in the perceived importance of setting attributes with variation in wilderness experience, knowledge, attachment, and motivation. Our results validate the emphasis of many wilderness management plans on indicators of social interaction, such as number of encounters.

Keywords Indicators · Limits of acceptable change · Recreation management · Social interaction · Wilderness experience

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Introduction

Providing opportunities for high quality visitor experiences is an important management objective in wilderness areas, as it is on all lands where recreation use is allowed and managed. In wilderness, this objective is usually considered subordinate to protection of biodiversity, ecological integrity, and naturalness (Hendee and Dawson 2002). Moreover, the types of experiences considered appropriate in wilderness are a small subset of the array of possible outdoor recreational experiences. In the United States, enabling legislation (The Wilderness Act of 1964) states that wilderness is to be used and enjoyed "as wilderness," going on to define that experience using three descriptors: "solitude," "primitive recreation," and "unconfined recreation."

One of the most basic tenets of outdoor recreation management is that the nature and quality of visitor experience are dependent on the conditions or settings that are experienced (Driver and Brown 1978). Hiking in a forest provides a different experience than hiking on a beach and hiking in throngs of other people differs from hiking alone. By controlling the setting (environmental, social and managerial conditions), managers influence the

nature and quality of experiences to a substantial degree. It should be noted, however, that experience quality is also strongly influenced by variables beyond the manager's control—by weather, within-group relationships, etc. By managing settings, managers increase the probability that certain experiences are realized (Driver and Brown 1978).

This importance of managing the setting to influence experience opportunities provides the foundation for several influential recreation management frameworks, most notably the Recreation Opportunity Spectrum (ROS) (Driver and others 1982), Limits of Acceptable Change (LAC) (Stankey and others 1985), and Visitor Experience and Resource Protection (VERP) (Manning 2001). Central to each of these is the need to identify setting attributes that influence experience quality, with a particular focus on attributes that are subject to managerial control. In the terminology of LAC and VERP, these attributes are indicators of experience quality. By developing standards for indicators—acceptable levels for each setting attribute—recreation managers specify the types of settings they intend to provide. This, in turn, will have a substantial influence on experience opportunities.

Identification of appropriate experiential indicators has been one of the factors limiting use of the LAC and VERP frameworks (McCool and Cole 1997). Common sense and experiential knowledge have been widely used to suggest appropriate indicators and lists of potential indicators have been compiled (e.g., Manning 1999). However, it has been argued that this approach has placed too much emphasis on a few indicators, most notably those associated with use density, such as the number of people encountered (Watson and Roggenbuck 1998).

To enlarge the source of knowledge and insight about potential indicators, some researchers have interviewed visitors, asking them directly about important qualities and characteristics of their experience. The intent of some of these studies has been to understand generally the nature of experiences and how they are constructed (Arnould and Price 1993, Farber and Hall 2007). Other studies have used interviews to understand the effects of specific attributes on experiences (Farrell and others 2001; White 2007). Finally, some have more explicitly attempted to develop indicators based on insights gleaned from interviews (Glaspell and others 2003; Watson and others 2007).

There have also been attempts to identify experiential indicators through empirical research on the effects of setting attributes (environmental, social and managerial) on the visitor experience. In early studies, visitors were typically asked to evaluate the degree to which various attributes (the number of visitors, the quality of trails, number of regulations etc.) affected their experience (e.g., Lucas 1980). With this approach, each respondent is evaluating the unique set of conditions that pertained to their trip. Responses suggest whether the conditions visitors happened to experience on their trip were problematic but the conflation of problem severity with problem frequency makes it difficult to draw generalizations. A potentially important indicator might be overlooked simply because it is currently not a problem.

In an attempt to overcome this limitation, subsequent studies have often asked generally how much influence various attributes have on experience quality. Visitors are asked to evaluate the importance of different attributes, regardless of whether they were problematic on their recent wilderness visit. Evaluations are hypothetical (relevant to how respondents *might be* affected) rather than actual (relevant to how respondents *were* affected). For example, Roggenbuck and others (1993) asked respondents how much they "care about" "the number of groups of hikers" seen along the trail, "the amount of litter" seen, etc. Theoretically, visitor responses to such questions should be independent of the conditions experienced. However, even with this approach respondents are evaluating different conditions, dependent on what they consider possible. For example, divergent responses regarding the importance of number of hiking groups might reflect one person envisioning meeting 10 other groups and someone else envisioning 1000 groups.

The objective of our study was to extend research into the effect of setting attributes on wilderness visitor experience. We attempted to overcome some of the limitations of previous research by maintaining a hypothetical approach but asking visitors how much various levels of each attribute (e.g., no groups, 1–2 groups, 5–7 groups, and more than 10 groups) would affect their experience. This approach is similar in some ways to what is commonly referred to as normative research (e.g., Whittaker and Shelby 1988; Manning and Freimund 2004) in which visitors are asked about the acceptability of various levels of attributes such as encounters. In our case, however, we were not attempting to identify standards for indicators. Rather we were attempting to identify important experiential indicators by assessing the degree to which different setting attributes affect experience. We used different response variables from the normative research and conducted different analyses.

Our study was motivated by an attempt to identify experiential indicators for use in a framework such as LAC. Consequently, most attention was given to setting attributes that managers can control to a substantial degree, even though we recognize that many of the most important influences on visitor experiences (e.g., weather, within-group dynamics) are beyond managerial control. We were particularly interested in identifying indicators with the attribute Manning (1999) refers to as "significant" and considers the most important attribute of a good indicator.

We use the term "important" to mean the same thing as significant. We consider an indicator to be important or significant if visitor experience is highly responsive to changes in the indicator variable.

We were also interested in the degree to which influential attributes varied among situational contexts and types of visitors. Knowledge about this variability is critical to understanding how robust and generalizable findings regarding appropriate indicators are across wilderness areas. The situational context we explored in this study was use density. Since people mold their expectations and learn to cope with high density situations (Manning and Valliere 2001), the influence of setting attributes on experience is likely to vary with density. Similarly, since studies suggest that day users have higher tolerance for crowding than overnight users (Cole 2000), attribute significance and importance is likely to differ between these groups. Consequently, we explored variation in the importance of setting attributes between very high use wilderness trails and less popular trails, as well as between day and overnight users.

Studies have shown that there are varied client groups with different tastes for recreation opportunities, even in wilderness (e.g., Manning 1999). Thus we explored how importance of setting attributes varied with trip motivations. Finally, it has been suggested that it is particularly important to learn from the opinions of visitors who are more experienced and possess more wilderness-oriented values, often referred to as wilderness "purists" (Hendee and others 1968). Therefore, we explored how the importance of setting attributes varied with several visitor characteristics related to purism—wilderness experience, knowledge about wilderness and wilderness attachment.

Methods

Study Areas

We conducted our study in two wilderness areas in the Pacific Northwest of the United States—Alpine Lakes Wilderness in Washington and Three Sisters Wilderness in Oregon. In the Pacific Northwest, many spectacular wilderness areas are located close to large metropolitan areas. Consequently, use levels—much of it day use—can be extremely high on certain trails. Wilderness managers are concerned about experience quality in these popular places. Some individuals question whether there is a need to limit use and what criteria (indicators and standards) should be employed when making use limitation decisions.

Responding to this concern, we conducted visitor surveys at 10 trailheads. Our sampling was designed to efficiently characterize the experiences of visitors to wilderness trails that receive very different levels of visitation, rather than to characterize experiences at any particular place. At Alpine Lakes, we contacted visitors at two very high use trailheads (Snow Lake and Pratt Lake), as well as three moderate use trailheads (Cathedral Pass, Gold Creek and Waptus River). At Three Sisters, we also contacted visitors at two very high use trailheads (Devils Lake and Green Lakes) and three moderate use trailheads (Sisters Mirror Lake, Elk Lake and Six Lakes). Visitation at the very high use trailheads, which are among the most popular wilderness trails in Oregon and Washington, was typically at least 100 people per day. Use on sunny weekend days sometimes exceeded 300 people. This contrasts with typical use levels of 15–20 people per day at moderate use trailheads. At these trailheads, there were summer weekdays when nobody visited. Even on peak weekend days, use levels seldom exceeded 50 people.

Sampling

For reasons of efficiency, we sampled groups of trailheads close to each other. Typically, each group of trailheads was sampled twice during the July–August summer season, each time over a 9-day block of time, to ensure inclusion of both weekdays and weekends. Researchers were present for at least six hours per day (usually 8 h), with sampling times adjusted to match the times of day that people were likely to be present. Researchers attempted to contact all adult (16 years and older) members of all groups as they exited the wilderness and asked them to participate. Since this was one of two different exit surveys, every other exiting adult was asked to fill out this questionnaire. About 72% agreed and were given a clipboard and questionnaire. We obtained 544 completed questionnaires, 384 at the very high use trailheads and 160 at the moderate use trailheads. We obtained 102 completed questionnaires from overnight visitors and 442 from day users.

Survey Instrument

The first question about wilderness experiences was open-ended, "what characteristics or qualities make a wilderness experience different from other experiences?" Respondents could identify as many attributes as they wanted. Subsequent questions contained scale items designed to assess the effect of setting attributes on the visitor experience. Most of these items were selected because they reflected negative influences on experiences that had been identified during an earlier study that employed in-depth interviews with visitors inside the wilderness. In that study, 183 visitors inside the Alpine Lakes Wilderness in Washington and the Mount Jefferson and Eagle Cap Wildernesses in Oregon were asked about the nature of their experience and

about attributes that affected experience. Those interviews, which averaged 35 min in length, suggested the most common adverse setting attributes were crowding and visitor behavior, bad weather, bugs, litter and ecological impacts.

Two sets of questions asked about the extent that various attributes would add to or detract from "your sense of having a real wilderness experience, if it happened to you," on a 7-point scale from +3 (would add a lot) to −3 (would detract a lot). We specifically asked respondents to "think about your answers in terms of what you think a wilderness experience should be—not whether you like or dislike the situation." One set of questions dealt with aspects of the social setting—interactions with others; the other dealt with aspects of the physical environment. Each set had multiple items, varying in level for each setting attribute. For example, regarding the attribute litter, individual scale items asked about "seeing no litter," "seeing a few pieces of litter," and "seeing lots of litter in many places."

To explore the extent to which effects varied consistently with visitor characteristics, we also asked questions about past wilderness experience, wilderness attachment, familiarity with the legal definition of wilderness and motivations for visiting wilderness. As is commonly done (Watson and Niccolucci 1992), we asked about three different domains of wilderness experience, visitation frequency (number of wilderness trips per year), local experience (the number of prior visits to the wilderness where the respondent was contacted), and general wilderness experience (the number of other wildernesses the respondent has visited). We assessed wilderness attachment, the degree of emotional or symbolic bonding between the individual and wilderness (Williams and others 1992), by asking about agreement with three statements: (1) "I find that a lot of my life is organized around wilderness use," (2) I feel like wilderness is a part of me," and (3) "I get greater satisfaction out of visiting wilderness than other areas." Response options ranged from +3 (strongly agree) to −3 (strongly disagree). We asked about familiarity with the legal definition of wilderness; four response options ranged from "I have no idea—I didn't even know there was a land classification of Wilderness" to "I think I know a lot about the legal definition of Wilderness." Finally, we asked visitors to respond to the importance of 13 different motivations for their wilderness trip, on a scale from 1 (not at all important) to 7 (extremely important).

Data Analysis

Responses to our open-ended question about what attributes make a wilderness experience unique were coded in broad classes. We conducted chi-square tests to assess whether the percentage of respondents who noted each class of attribute varied with amount of use or length of stay. Tests were two-tailed, with an alpha of 0.05.

To assess attribute importance (or significance), we posited that importance increases as the difference between high and low scores for any attribute increases. For example, if the difference in experience effect between seeing lots of litter and no litter is greater than the difference between seeing lots of people and no people, we conclude that litter is a more important attribute than number of people. Attribute importance was calculated as the difference between high and low scores for the individual levels of each attribute. In the case of litter, the mean score for "seeing no litter" was 2.5 on a scale from +3 (would add a lot) to −3 (would detract a lot); mean score for "seeing lots of litter" was −2.7. Thus our metric for attribute importance was 5.2 (2.5 minus −2.7) on a scale from 0 (unimportant) to 6 (highly important).

To assess the effect of situational context on attribute importance, we conducted three-factor analyses of variance, using mixed models, with attribute importance as the dependent variable and wilderness, amount of use (very high or moderate) and length of stay (day or overnight) as main factors. For several attributes that were not relevant to day users, only overnight users were included and we used a two-factor analysis of variance to assess the effect of amount of use.

Since most visitor characteristics were categorical variables, we assigned respondents to either a high or a low-to-moderate category in order to assess whether attribute importance varied with these characteristics. For each variable, 21–32% of the population was in the high category. Members of the high category visit wilderness more than 10 times a year, have been to more than 20 other wildernesses, have visited the wilderness where they were contacted more than 5 times, had a wilderness attachment score higher than 2.0 (on a scale from −3 to +3), self-reported that they "know a lot about the legal definition of Wilderness" and had a mean motivation score of 6.0 or higher (on a scale of 1–7) for 13 motivations for visiting wilderness. For each of these visitor characteristics, we conducted *t* tests to assess whether attribute importance differed between high and low-to-moderate categories.

Results

Visitor Characteristics

Day users were more common than overnight users, comprising 86% of the users at the very high use trailheads and 69% of the users at the moderate use trailheads. Men were slightly more common (54%) than women and the median

age was 40 years. Most respondents had substantial wilderness experience. Thirty-two percent of respondents report making more than 10 wilderness trips per year. For local experience, 24% had visited the wilderness where they were contacted more than 5 times before and, for general experience, 30% had been to more than 20 other wilderness areas. For wilderness knowledge, 24% self-reported that they know a lot about the legal definition of wilderness. Wilderness attachment was generally high; mean attachment was 1.5 on a scale from −3 to +3. Motivation was also high, with an overall mean score of 5.2 on a scale of 1 (not important at all) to 7 (extremely important) for all 13 individual motivations.

Effects of Setting Attributes on Experience

The open-ended question about what makes wilderness experiences different from other experiences was asked to assess the importance of the attributes the survey addressed in more detail. The most commonly mentioned attributes were solitude (mentioned by 33% of respondents) and quietness (16%), a condition related to solitude, along with scenery (31%) and lack of impact (25%) (Fig. 1). Challenge and the related attribute of self-sufficiency were also frequently mentioned. In addition to being a place where there is no impact, many respondents view wilderness as a place that is clean, without trash, without development and remote. A variety of psychological outcomes other than solitude were also noted, particularly having a sense of escape and an opportunity for spiritual development.

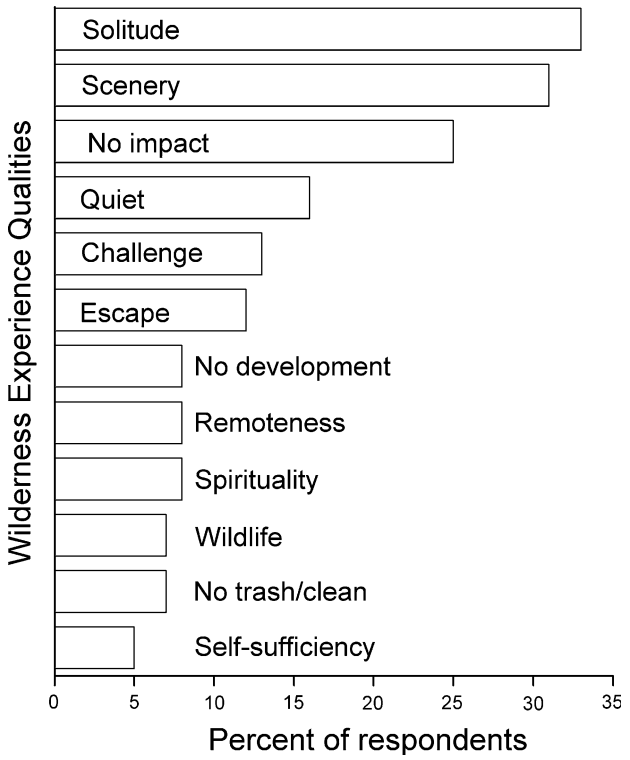

Fig. 1 Percent of respondents who mentioned specific qualities that make a wilderness experience unique, asked in open-ended format

Social setting attributes either added to or detracted from the wilderness experience, depending on the level of the attribute (Fig. 2). For example, experiencing "no one walk through your camp or rest area" added to the experience; mean effect was 1.95 on a scale from 3 (adds a lot) to −3 (detracts a lot). In contrast, experiencing "people walk through your camp or rest area many times" detracted from the experience; mean effect was −2.29. In all cases, the absence of various types of human interaction added to the ability to have a real wilderness experience (i.e., mean effects were greater than 0). The magnitude of positive effect did not vary substantially among the types of interaction we inquired about. Having nobody walk through camp had the largest positive effect (mean effect of 1.95), while being able to immediately find an unoccupied campsite had the smallest positive effect (mean effect of 1.58).

There was variation among attributes, however, in the magnitude of adverse effect when there were high levels of interaction. The situations that most adversely affected experiences were interactions at the campsite. The mean effect of having people walk through camp many times was −2.29 on a scale from 3 (adds a lot) to −3 (detracts a lot) and the mean effect of camping close to just one other group was −1.61. Hearing sounds from other groups most of the day was also perceived to have a pronounced adverse effect (mean effect of −1.80). Less problematic were seeing more than 10 other groups in a day (mean effect of −1.16) and sharing a viewpoint with several other groups (mean effect of -0.96). For the campsite interactions, most people reacted negatively to any level of intrusion or encounter. In contrast, seeing one to two other groups in the day was perceived by most people to add to the experience (mean effect of 0.70).

Many of the aspects of the physical environment we asked about also added to or detracted from the experience, depending on level (Fig. 3). Litter elicited the most extreme responses—adding greatly to the experience when it was absent (mean effect of 2.52) and detracting greatly when there was lots of it in many places (mean effect of −2.70). Frequent airplane overflights were also considered to detract substantially from the ability to have a real wilderness experience (mean effect of −1.56). Finding more than 10 campsites at a destination was moderately problematic (mean effect of −1.21), but arriving at a destination to find little evidence of previous use (no obvious campsites) did not add much to experience quality (mean effect of 0.54).

In questions about trail signage, trail development and bridge construction, we explored whether or not lack of

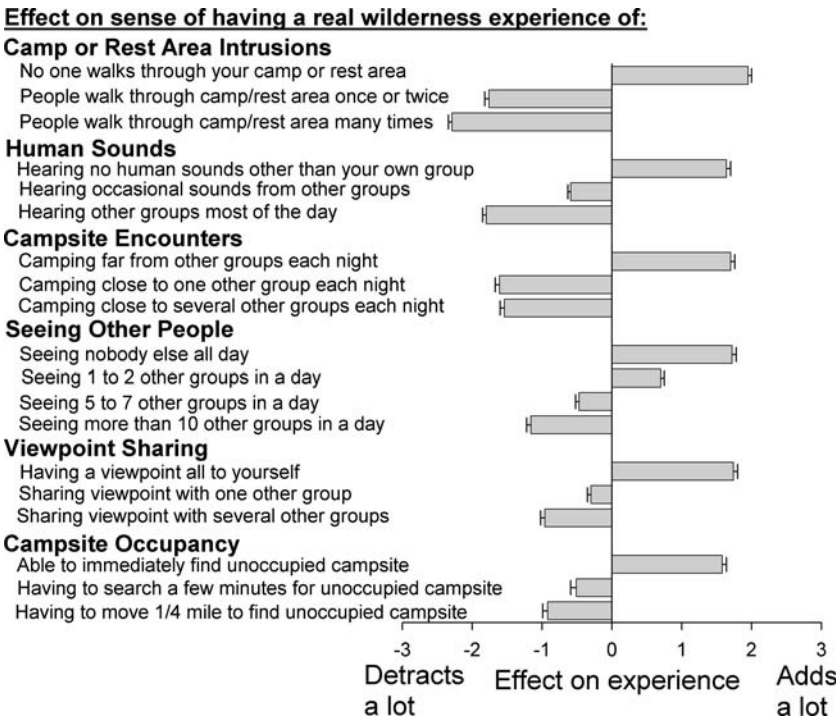

Fig. 2 Perceived effect of social setting attributes on one's sense of having a real wilderness experience—mean and standard error on a scale from 3 (adds a lot) to −3 (detracts a lot)

signs and development were considered conducive to a wilderness experience. In contrast to our expectations, signs with destinations and mileage within wilderness were perceived to add to the wilderness experience (mean effect of 0.73), while a lack of signs was perceived to detract from the experience (mean effect of −0.91). Well-constructed bridges across creeks had much more positive effects on experience (mean effect of 0.93) than having to get one's feet wet, due to lack of a bridge (mean effect of 0.03). There was little variation in the perceived effect of different levels of trail construction on experience; mean effect varied from 0.43 for traveling all day away from trails to 0.26 for traveling on narrow, rocky trails.

As noted in the data analysis section, we assessed the importance of different attributes on the basis of the magnitude of difference between high and low scores for individual levels. Attribute importance scores have a maximum possible value of 6.0 when one level (e.g., seeing no litter) is given a rating of 3 (adds a lot to the experience) and another level (e.g., seeing lots of litter) is given a rating of −3 (detracts a lot). The minimum possible score is 0. Amount of litter was the setting attribute with the highest importance score (5.3), the difference between the mean rating of 2.5 for "seeing no litter" and the mean rating of −2.7 for "seeing lots of litter in many places." Campsite intrusions, campsite encounters and prevalence of human sound were all more important than attributes such as wildlife sightings and weather (Table 1). The least important attributes were trail signage and development, bridge construction and number of campsites.

Variation with Situational Context

In the open-ended question about attributes that make a wilderness experience unique, people exiting moderate use trails were significantly more likely then very high use trail users to mention solitude ($\chi^2 = 11.5$, $P < 0.001$) and quiet ($\chi^2 = 6.0$, $P = 0.01$). For example, 44% of people on moderate use trails mentioned solitude, compared to 28% of people on very high use trails. No attributes were mentioned significantly more often by very high use trail users. Compared to overnight users, day users mentioned scenery ($\chi^2 = 6.6, P = 0.01$), quiet ($\chi^2 = 7.5, P = 0.01$) and lack of trash ($\chi^2 = 6.9$, $P = 0.01$) significantly more often, while overnight users mentioned challenge ($\chi^2 = 9.5$, $P = 0.01$), self-sufficiency ($\chi^2 = 6.7$, $P = 0.01$) and lack of development ($\chi^2 = 6.6$, $P = 0.01$) more often.

Attribute importance scores did not vary significantly between the two wildernesses ($F = 0.0$–1.8, $P = 0.18$–0.91, depending on the attribute) and interactions between amount of use and length of stay were not significant ($F = 0.0$–1.9, $P = 0.17$–0.99, depending on the attribute). This simplified the interpretation of the main factors of interest, level of use and length of stay. None of the 14 attributes differed in importance between day and overnight users and only two attributes varied significantly in importance between visitors to very high and moderate use trails (Table 2). The number of people seen was considered more important by visitors to moderate use trails. For example, "seeing nobody else all day" added more to the experience of people on moderate use trails than on very high use trails

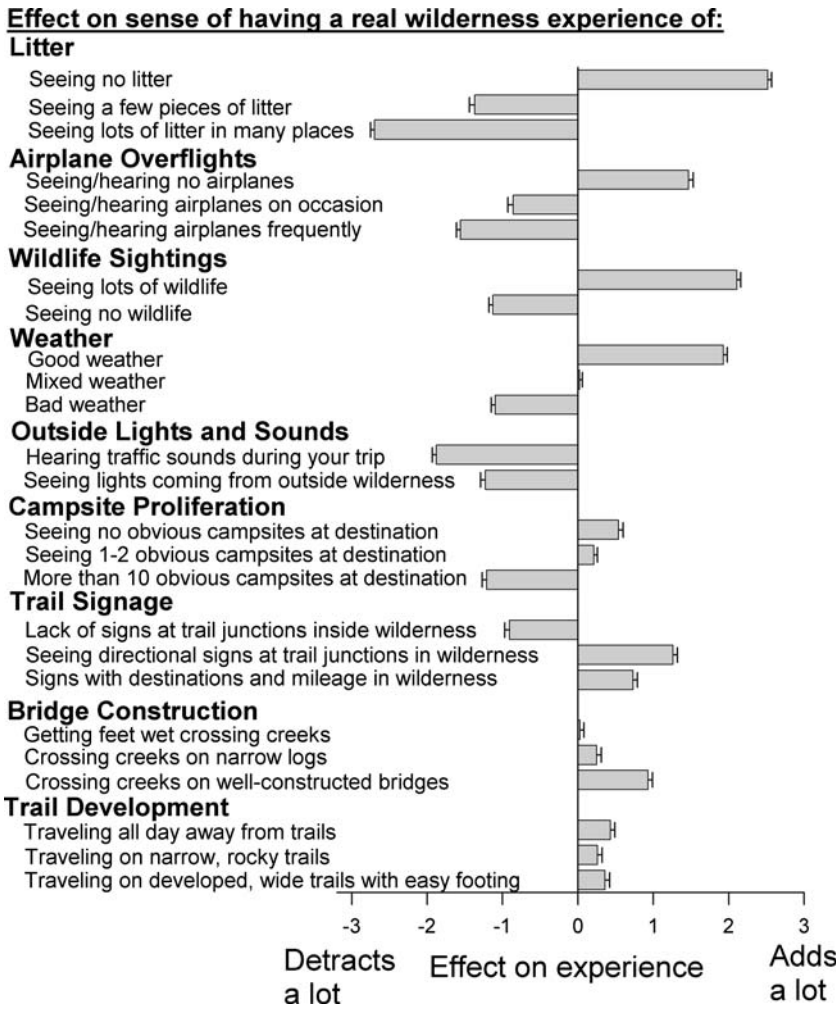

Fig. 3 Perceived effect of environmental setting attributes on one's sense of having a real wilderness experience—mean and standard error on a scale from 3 (adds a lot) to −3 (detracts a lot)

Table 1 Importance scores[a] for setting attributes

	N	Mean	Standard deviation
Litter	473	5.3	1.5
Camp intrusions[b]	99	4.6	1.9
Campsite encounters[b]	96	3.9	1.9
Human sounds	496	3.5	2.0
Wildlife sightings	476	3.3	1.7
Seeing other people	503	3.1	2.0
Difficulty of finding an unoccupied campsite[b]	96	3.1	2.0
Airplane overflights	480	3.1	2.1
Weather	472	3.1	1.9
Viewpoint sharing	495	2.8	1.9
Trail signage	468	2.2	1.7
Campsite proliferation	480	2.1	1.8
Bridge construction	483	1.5	1.5
Trail development	462	1.6	1.5

[a] The importance score is the difference between high and low scores for the individual levels of each attribute (maximum value of 6.0; minimum value of 0.0)

[b] Only overnight user responses are reported

and "seeing more than 10 other groups in a day" detracted more from the experience of people on moderate use trails (Fig. 4). Degree of bridge construction, while not among the more important attributes, was more important to visitors to very high use trails. Regardless of trail use level, visitors felt that getting one's feet wet crossing a creek had

Table 2 Effect of use level and length of stay on importance scores[a] (mean and standard error) for setting attributes

Attribute	Use level			Length of stay		
	High $N \approx 350$	Mod. $N \approx 155$	P[b]	Day $N \approx 405$	Over. $N \approx 100$	P[b]
Litter	5.3 (.1)	5.4 (.1)	0.88	5.3 (.1)	5.4 (.1)	0.75
Camp intrusions	4.6 (.3)	4.5 (.3)	0.88	–	–	–
Campsite encounters	3.6 (.3)	4.2 (.3)	0.14	–	–	–
Human sounds	3.4 (.1)	3.8 (.2)	0.08	3.4 (.1)	3.9 (.2)	0.26
Wildlife sightings	3.2 (.1)	3.5 (.2)	0.60	3.3 (.1)	3.6 (.2)	0.18
Seeing other people	2.8 (.1)	3.8 (.2)	<0.01	3.1 (.1)	3.4 (.2)	0.94
Difficulty of finding an unoccupied campsite	3.3 (.3)	3.1 (.3)	0.65	–	–	–
Airplane overflights	3.0 (.1)	3.3 (.2)	0.43	3.1 (.1)	2.9 (.3)	0.15
Weather	3.0 (.1)	3.1 (.2)	0.42	3.1 (.1)	3.0 (.2)	0.60
Viewpoint sharing	2.8 (.1)	3.0 (.2)	0.19	2.8 (.1)	3.1 (.2)	0.31
Trail signage	2.2 (.1)	2.4 (.2)	0.98	2.1 (.1)	2.6 (.2)	0.18
Campsite proliferation	2.1 (.1)	2.1 (.2)	0.73	2.0 (.1)	2.3 (.2)	0.48
Bridge construction	1.7 (.1)	1.3 (.1)	0.03	1.6 (.1)	1.7 (.2)	0.40
Trail development	1.7 (.1)	1.6 (.1)	0.44	1.6 (.1)	1.8 (.2)	0.38

[a] The importance score is the difference between high and low scores for the individual levels of each attribute (maximum value of 6.0; minimum value of 0.0)

[b] Differences were considered to be statistically significant for $P \leq 0.05$, based on a 3-factor (use level, length of stay and wilderness) ANOVA. Two-factor ANOVA was used for three attributes that were not relevant to day users

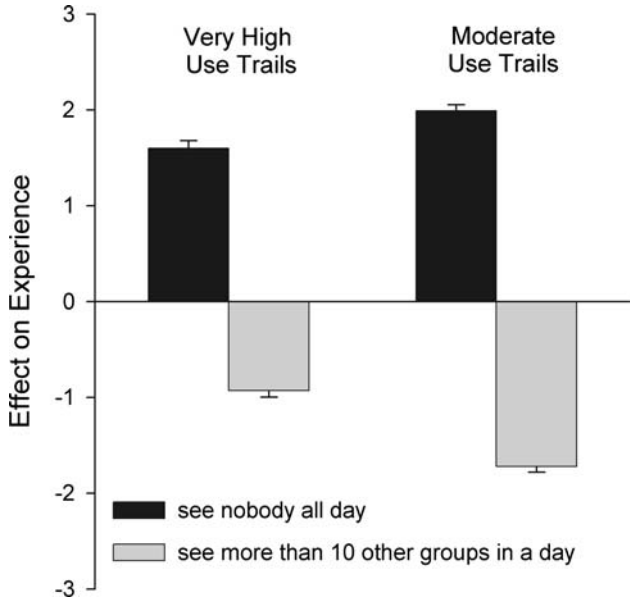

Fig. 4 Perceived effect of number of encounters on experience—mean and standard error on a scale from 3 (adds a lot) to −3 (detracts a lot); variation with trail use level

little effect on their experience. Most visitors were more positive about the effect of constructed bridges on the experience, with visitors to very high use trails more likely to report that constructed bridges added to their wilderness experience.

Variation with Visitor Characteristics

To assess whether attribute importance varied among visitors with different trip motivations, we performed a cluster analysis of visitors on the basis of the importance of 13 different motivations for their trip (freedom, solitude, to think about who I am, closeness to nature, learn about this place, wilderness, remoteness, sense that surroundings haven't been impacted by people, to be away from crowds of people, challenge, to be away from the modern world, be my own boss, and to develop personal, spiritual values). We found that clusters varied in the importance assigned to all motivations but not in the relative importance of individual motivations. That is, one cluster consisted of visitors who felt that all these motivations were highly important while another cluster consisted of visitors who felt that all these motivations were only moderately important; clusters did not have distinctive patterns of response, in which one motivation was rated as important and another rated as unimportant. Consequently, we simply ranked people on the basis of the mean importance of all 13 motivations and assigned those with a mean motivation score of 6.0 or higher (on a scale of 1–7) to the high motivation category (21% of the population).

The importance of most setting attributes varied among visitors with different levels of wilderness experience (Table 3). Generally, attribute importance scores tended to be higher among visitors with more experience, suggesting that they were more sensitive to variation in setting

Table 3 Effect of visitors' wilderness experience on the importance scores[a] (mean and standard error) for setting attributes

Setting attribute	Visit frequency[b]			Local experience[b]			General experience[b]		
	High $N \approx 135$	Low $N \approx 340$	P[c]	High $N \approx 105$	Low $N \approx 370$	P[c]	High $N \approx 130$	Low $N \approx 345$	P[c]
Litter	5.4 (.1)	5.2 (.1)	0.10	5.5 (.1)	5.2 (.1)	0.02	5.3 (.1)	5.3 (.1)	0.64
Camp intrusions	4.6 (.2)	4.2 (.1)	0.04	4.6 (.2)	4.2 (.1)	0.08	4.6 (.2)	4.2 (.1)	0.05
Campsite encounters	3.6 (.2)	3.2 (.1)	0.04	3.6 (.2)	3.3 (.1)	0.18	3.6 (.2)	3.2 (.1)	0.11
Human sounds	3.9 (.2)	3.3 (.1)	<0.01	4.0 (.2)	3.4 (.1)	0.01	3.8 (.2)	3.4 (.1)	0.04
Wildlife sightings	3.3 (.1)	3.3 (.1)	0.89	3.6 (.2)	3.2 (.1)	0.07	3.3 (.2)	3.3 (.1)	0.78
Seeing other people	3.7 (.2)	2.9 (.1)	<0.01	3.3 (.2)	3.1 (.1)	0.35	3.5 (.2)	3.0 (.1)	0.01
Difficulty of finding an unoccupied campsite	2.7 (.2)	2.7 (.1)	0.73	2.7 (.2)	2.7 (.1)	0.68	2.6 (.2)	2.8 (.1)	0.40
Airplane overflights	3.2 (.2)	3.0 (.1)	0.43	3.1 (.2)	3.1 (.1)	0.73	3.2 (.2)	3.1 (.1)	0.59
Weather	2.8 (.2)	3.2 (.1)	0.02	3.0 (.2)	3.1 (.1)	0.70	2.8 (.2)	3.1 (.1)	0.09
Viewpoint sharing	2.9 (.2)	2.8 (.1)	0.54	2.9 (.2)	2.8 (.1)	0.52	2.8 (.2)	2.8 (.1)	0.98
Trail signage	2.1 (.2)	2.2 (.1)	0.69	2.3 (.2)	2.2 (.1)	0.48	1.9 (.2)	2.3 (.1)	0.05
Campsite proliferation	2.5 (.2)	1.9 (.1)	<0.01	2.1 (.2)	2.1 (.1)	0.96	2.2 (.2)	2.0 (.1)	0.33
Bridge construction	1.5 (.2)	1.6 (.1)	0.68	1.6 (.1)	1.5 (.1)	0.63	1.5 (.1)	1.6 (.1)	0.64
Trail development	1.9 (.1)	1.5 (.1)	0.01	1.8 (.2)	1.7 (.1)	0.17	1.9 (.1)	1.5 (.1)	0.04

[a] The importance score is the difference between high and low scores for the individual levels of each attribute (maximum value of 6.0; minimum value of 0.0)

[b] Respondents in the high category for visit frequency visit wilderness more than 10 times/year. High category respondents for local experience had visited the wilderness where they were contacted more than 5 times and for general experience had visited more than 20 other wildernesses

[c] Differences were considered to be statistically significant for $P \leq 0.05$, based on t-tests

attributes. Of the three domains of experience we explored, local experience (how often respondents had visited the wilderness where we contacted them) had less influence on attribute importance than either general experience (the number of different wilderness areas visited) or visit frequency (number of wilderness visits per year). The only attribute that varied significantly with all three of the experience domains was prevalence of human sounds. The five attributes that did not vary with any of the experience domains were wildlife sightings, the difficulty of finding a campsite, airplane overflights, viewpoint sharing, and bridge construction. Weather was significantly less important to respondents who visit wilderness frequently and trail signage was less important to visitors with more general wilderness experience.

The importance of most setting attributes also varied among visitors with different levels of wilderness knowledge, wilderness attachment and motivational intensity (Table 4). Generally, attribute importance scores tended to be higher among visitors with higher levels of these indicators of wilderness purism. For example, compared to less attached visitors, respondents with high wilderness attachment scores perceived that their experience would be more adversely affected by seeing lots of people and also more positively affected by seeing nobody (Fig. 5). The only attribute that did not vary in importance with any of these visitor characteristics was trail signage and the one attribute that was significantly less important to more knowledgeable visitors was weather. More setting attributes varied significantly with wilderness attachment and motivational intensity than with wilderness knowledge or any of the experiential domains. Differences among attachment and motivation categories were also typically larger.

Despite these statistically significant differences in absolute importance, the relative importance of these attributes did not vary much with visitor characteristics. This can be explained by the fact that the more experienced, knowledgeable, attached and motivated visitors (the purists) considered most of these attributes to be more important than other visitors. The primary differences in relative importance were that (1) the purists considered number of people and campsite encounters to be among the most important attributes, rather than of medium importance and (2) the non-purists considered weather to be among the most important attributes, rather than of medium importance.

Discussion and Conclusion

Our results are consistent with the proposition that setting attributes, many of which management can control,

Table 4 Effect of visitors' wilderness knowledge, wilderness attachment and trip motivations on the importance scores[a] (mean and standard error) for setting attributes

Setting attribute	Knowledge[b]			Attachment[b]			Motivation[b]		
	High $N \approx 110$	Low $N \approx 365$	P^c	High $N \approx 130$	Low $N \approx 335$	P^c	High $N \approx 90$	Low $N \approx 350$	P^c
Litter	5.4 (.1)	5.2 (.1)	0.17	5.4 (.1)	5.2 (.1)	0.27	5.6 (.1)	5.2 (.1)	<0.01
Camp intrusions	4.5 (.2)	4.2 (.1)	0.17	4.9 (.2)	4.1 (.1)	<0.01	5.0 (.2)	4.2 (.1)	<0.01
Campsite encounters	3.8 (.2)	3.2 (.1)	<0.01	4.1 (.2)	3.0 (.1)	<0.01	4.1 (.2)	3.2 (.1)	<0.01
Human sounds	3.8 (.2)	3.4 (.1)	0.06	3.9 (.2)	3.4 (.1)	0.01	4.1 (.2)	3.4 (.1)	<0.01
Wildlife sightings	3.5 (.2)	3.3 (.1)	0.31	3.3 (.2)	3.3 (.1)	0.84	3.8 (.2)	3.1 (.1)	<0.01
Seeing other people	3.5 (.2)	3.0 (.1)	0.01	4.0 (.2)	2.8 (.1)	<0.01	3.9 (.2)	3.0 (.1)	<0.01
Difficulty of finding an unoccupied campsite	2.7 (.2)	2.7 (.1)	0.97	3.1 (.2)	2.7 (.1)	0.04	3.1 (.2)	2.7 (.1)	0.04
Airplane overflights	3.1 (.2)	3.1 (.1)	0.87	3.7 (.2)	2.8 (.1)	<0.01	3.6 (.2)	2.9 (.1)	<0.01
Weather	2.5 (.2)	3.2 (.1)	<0.01	2.9 (.2)	3.1 (.1)	0.27	3.1 (.2)	3.0 (.1)	0.64
Viewpoint sharing	3.0 (.2)	2.8 (.1)	0.22	3.2 (.2)	2.7 (.1)	0.01	3.4 (.2)	2.7 (.1)	<0.01
Trail signage	2.0 (.2)	2.2 (.1)	0.30	2.2 (.2)	2.2 (.1)	0.95	2.2 (.2)	2.1 (.1)	0.97
Campsite proliferation	2.6 (.2)	1.9 (.1)	<0.01	2.7 (.2)	1.9 (.1)	<0.01	2.6 (.2)	2.0 (.1)	<0.01
Bridge construction	1.3 (.1)	1.6 (.1)	0.02	1.7 (.1)	1.5 (.1)	0.08	1.7 (.1)	1.5 (.1)	0.24
Trail development	1.8 (.2)	1.6(.1)	0.16	2.1 (.2)	1.5 (.1)	<0.01	1.9 (.2)	1.6 (.1)	0.13

[a] The importance score is the difference between high and low scores for the individual levels of each attribute (maximum value of 6.0; minimum value of 0.0)

[b] Respondents in the high category for wilderness knowledge self-reported that they "know a lot about the legal definition of wilderness." High category respondents were those with a wilderness attachment score higher than 2.0 (on a scale from −3 to 3) and an overall mean motivation score of 6.0 or higher (on a scale of 1–7) for 13 trip motivations

[c] Differences were considered to be statistically significant for $P \leq 0.05$, based on t tests

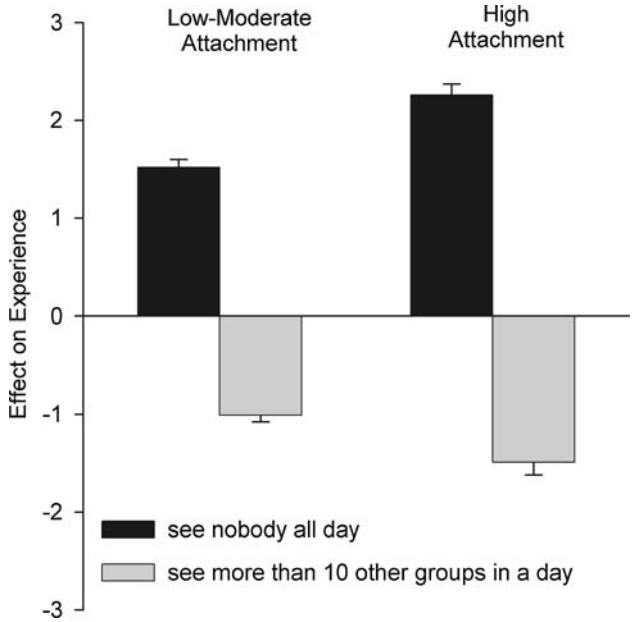

Fig. 5 Perceived effect of number of encounters on experience—mean and standard error on a scale from 3 (adds a lot) to −3 (detracts a lot); variation with wilderness attachment level

influence the ability of visitors to have what they consider to be a "real wilderness experience." They lend support to the utility of management frameworks, such as Limits of Acceptable Change (LAC), that consider setting attributes to be proximate outcomes that wilderness managers seek to provide. By maintaining desired/acceptable wilderness settings, managers optimize the opportunities for visitors to have high quality wilderness experiences—the ultimate outcome of management action.

There are a number of desirable characteristics of indicators, including that they be measurable, reliable, cost-effective, relevant, significant, sensitive, efficient and responsive (Merigliano 1990; Watson and others 2007). Of these attributes, managers have found it particularly difficult to identify the most significant indicators, those that reflect changes in attributes that, if they were to occur, would seriously impair values (Watson and Cole 1992). Our approach, by assessing the perceived sensitivity of experience to different setting attributes, provides an empirical foundation for making decisions about the most significant indicators of wilderness settings.

Our results generally validate findings from earlier studies, suggesting that some of the methodological limitations of those studies that we sought to remedy were not as limiting as we feared. As previously reported (Roggenbuck and others 1993; Shafer and Hammitt 1995a; Lynn and Brown 2002), amount of litter was perceived to have a particularly substantial effect on experience. A

number of indicators of social interaction were also perceived to have profound effects. Our results confirm the special importance of interaction at campsites (Stankey 1973; Roggenbuck and others 1993). Campsite encounters are more important than the number of people seen during the day. Behavior in and around campsites is important as well. Having someone walk through camp is more influential than merely having someone camped close by.

Our method of multi-level assessment of attributes demonstrated that most—but not all—setting attributes have both positive and negative states. For the social interaction attributes, lack of interaction added to experiences while level of detraction generally increased as level of interaction increased. The influence of different types of social interaction was determined more by the magnitude of adverse effect (when substantial interaction occurred) than the magnitude of positive effect (when interaction did not occur). This confirms the utility of exploring the adverse effects of social interaction, despite the fact that not all social interactions are deleterious. Some interactions can add to the quality of the visitor experience (Jonas and others 2000; Glaspell and others 2003).

Our multi-level assessments also suggest the levels at which certain attributes shift from being positive to negative in effect. In this way, our results can be used much like the results of normative research to suggest potential standards (e.g., Manning and Freimund 2004). For some attributes, the thresholds above which experience detraction occur, are extremely low. Norms for such attributes have been referred to as zero-tolerance norms (Whittaker and Shelby 1988). Even a few pieces of litter have an adverse effect, as do even occasional airplane overflights and level of social interaction at campsites. In contrast, seeing 1 or 2 other groups per day is still perceived positively, while 5 to 7 per day is perceived negatively. Seeing 1 or 2 obvious campsites at a wilderness destination is perceived positively, while seeing more than 10 obvious campsites is perceived negatively. These perceived thresholds suggest possible standards for these attributes, if managers seek to avoid any degree of detraction from the wilderness experience of current visitors.

For signage, bridge construction and trail development, presence of these "developments" was perceived as adding to rather than detracting from the ability to have a real wilderness experience. Moreover, in the case of signs, absence detracted rather than added to the experience. This suggests that either (1) most wilderness visitors do not consider the challenge and self-sufficiency associated with finding one's way without signs and negotiating wilderness terrain without well-constructed trails and bridges to be important to having a real wilderness experience or (2) they prefer the convenience of signs, trails and bridges to the challenge associated with their absence.

Since standards for attributes such as number of encounters often vary with use density (e.g., Cole and Stewart 2002), we expected that attribute importance might also vary with use density. However, the perceived importance of setting attributes did not vary much between wilderness locations with substantial differences in amount of use. In combination with the finding of Roggenbuck and others (1993) that the importance of social and resource conditions varied little across four different wildernesses located in different regions of the United States, this suggests that conclusions about the importance of many setting attributes are robust and generalizable across wilderness areas. There also was little difference in the perceptions of day and overnight visitors. This is consistent with the findings of Cole (2000) that there are few differences between day and overnight visitors in trip characteristics, experience evaluations and management preferences. However, it seems inconsistent with the finding that day users are more tolerant of large numbers of encounters than overnight users (Cole 2000). Again, this suggests more variation in standards for attributes than in the importance of attributes.

In contrast, we found substantial variation in the perceived importance of setting attributes with variation in wilderness experience, knowledge, attachment and motivation. Several setting attributes were particularly important to visitors with more wilderness experience and more knowledge about the legal definition of wilderness. However, the greatest variation in attribute importance was related to wilderness attachment and the intensity of one's experience motivations. The responses of more attached visitors, with more intense wilderness-related motives, suggest that they are more sensitive to the conditions they encounter. They attach more importance to the level of social interaction that occurs and are less supportive of developments that facilitate travel (such as signs, well-developed trails and bridges). This is consistent with Shafer and Hammitt (1995b) who reported that wilderness "purists" were particularly concerned about a number of setting attributes consistent with the realization of wilderness experiences and that purists attached more importance than others to solitude and less-importance to management-aided travel. It suggests that measures of wilderness attachment and wilderness-related experience motivations, similar to those we used, can effectively identify wilderness purists, should managers be particularly interested in their opinions.

In most of the wilderness management plans developed using LAC or a similar process, there has been a heavy reliance on indicators of social interaction, such as number of encounters. Although this reliance on indicators of social interaction has been criticized (Watson and Roggenbuck 1998), our results suggest that such indicators are

highly significant to most visitors. They are indicative of setting attributes, subject to managerial control, that most visitors perceive to have a strong influence on their wilderness experience. This is consistent with recent work, in a lightly-used national park in the Arctic, where researchers assessed the influence of setting attributes on experience domains derived from interviews with park visitors. Number of encounters with others was the most influential indicator related to two of the three experience domains for which indicators could be identified (Watson and others 2007). Finally, it is notable that number of encounters is a highly significant indicator both on the heavily-used wilderness trails where we worked and in the extremely lightly-used park where Watson and others (2007) worked. This suggests that these social interaction indicators are likely to be relevant in virtually all wilderness areas.

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