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Wilderness Science in a Time of Change Conference

Volume 4: Wilderness Visitors, Experiences, and Visitor Management

Missoula, Montana
May 23–27, 1999

Abstract

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Thirty-seven papers are presented on wilderness visitors, experiences, and visitor management. Three overview papers synthesize knowledge and research about wilderness visitors, management of visitor experiences, and wilderness recreation planning. Other papers contain the results of specific research projects on wilderness visitors, information and education, and visitor management.

Keywords: recreation fees, recreation management, standards, visitor behavior, visitor education, visitor perception, visitor satisfaction, wilderness use

RMRS-P-15-VOL-1. **Wilderness science in a time of change conference—Volume 1: Changing perspectives and future directions**.

RMRS-P-15-VOL-2. **Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems**.

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Compilers

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Compilers

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Preface

The Wilderness Science in a Time of Change Conference was held in Missoula, Montana, May 23 through 27, 1999. The conference was conceived to be both a followup and an expansion of the first National Wilderness Research Conference, held in Fort Collins, Colorado, in 1985. That conference brought together most of the scientists in the world who are working on issues related to the management of wilderness and resulted in literature reviews and compilations of research that remain critical references today (Lucas 1986, 1987). Our intent was to bring scientists together again, along with wilderness managers, to produce an updated compendium of the current state-of-knowledge and current research. In addition, we sought to increase the array of scientific disciplines represented at the conference and to expand the range of topics beyond the challenges of managing wilderness. Finally, we hoped to use plenary talks to highlight controversy, divergent viewpoints, and management dilemmas—to challenge participants' belief systems—in the hopes that this would stimulate interaction and personal growth.

Well over 400 people participated in the conference. Conference attendees included a roughly equal mix of people from federal land managing agencies and from academia. There were also several representatives from state, local, and tribal governments. There were more than 30 attendees from 16 different nongovernmental organizations, as well as a number of private individuals, consultants, and members of the press. About 20 participants were from Canada, with about 20 more participants from other countries. We succeeded in attracting people from diverse disciplines, united in their interest in wilderness. As usually is the case, a large proportion of the researchers who attended specialize in the social science aspects of outdoor recreation. However, attendees also included other types of social scientists, philosophers, paleontologists, and life scientists interested in all scales of analysis from cells to the globe.

The conference consisted of plenary talks to be presented before the entire conference, as well as more narrowly focused presentations organized around three conference themes and presented in concurrent sessions. The conference's plenary talks were organized into four sessions: (1) global trends and their influence on wilderness, (2) contemporary criticisms and celebrations of the idea of wilderness, (3) the capacity of science to meet the challenges that wilderness faces and to realize the opportunities that wilderness presents, and (4) concluding talks related to conference themes.

The bulk of the conference was organized around three themes. The first theme was "Science for Understanding Wilderness in the Context of Larger Systems." The emphasis of this theme was better understanding of the linkages between wilderness and the social and ecological systems (regional, national, and international) in which wilderness is situated. The emphasis of the second theme, "Wilderness for Science: A Place for Inquiry," was better understanding of what we have learned from studies that have utilized wilderness as a laboratory. The third and most traditional theme was "Science for Wilderness: Improving Management." The emphasis of this theme was better understanding of wilderness visitors, threats to wilderness values, and means of planning for and managing wilderness.

We organized three types of sessions under each of these three themes. We invited 18 speakers to present overview papers on specific topical areas under each theme. Many of these speakers developed comprehensive state-of-knowledge reviews of the literature for their assigned topic, while others developed more selective discussions of issues and research they judged to be particularly significant. In addition, conference participants were given the opportunity to contribute either a traditional research paper or to organize a dialogue session. Most of the research papers (131 papers) were presented orally, but 23 additional papers were presented in a poster session. The 14 dialogue sessions were intended to promote group discussion and learning.

The proceedings of the conference is organized into five separate volumes. The first volume is devoted to the papers presented during the plenary sessions. Subsequent volumes are devoted to each of the three conference themes, with two volumes devoted to wilderness management, the theme with the most papers. Within each theme, papers are organized into overview papers, research papers, and papers from the dialogue sessions. The format of dialogue session papers varies with the different approaches taken to capture the significant outcomes of the sessions. Research papers include papers presented orally and on posters. Within each theme, research papers are organized into broad topical areas. Although the initial draft of each proceedings paper was reviewed and edited, final submissions were published as submitted. Therefore, the final content of these papers remains the responsibility of the authors.

We thank the many individuals and institutions on the lists of committee members and sponsors that

follow. They all contributed to the success of the conference.

Planning Committee: Joan Brehm, Perry Brown, David Cole, Wayne Freimund, Stephen McCool, Connie Myers, and David Parsons.

Program Committee: David Cole (Co-chair), Stephen McCool (Co-chair), Dorothy Anderson, William Borrie, David Graber, Rebecca Johnson, Martha Lee, Reed Noss, Jan van Wagtendonk, and Alan Watson.

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Steering Committee Members: Perry Brown (Co-Chair), David Parsons (Co-Chair), Norman Christensen, Rick Coleman, Chip Dennerlein, Dennis Fenn, Denis Galvin, David Harmon, John Hendee, Jeff Jarvis, Kenneth Kimball, Luna Leopold, Robert Lewis, David Lime, Nik Lopoukhine, James MacMahon, Michael Manfredo, William Meadows, III, Chris Monz, Margaret Shannon, Jack Ward Thomas, and Hank Tyler.

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—The Compilers

Contents

Wilderness Visitors, Experiences, and Visitor Management

David N. Cole
Stephen F. McCool

Wilderness areas are managed to protect their wilderness character, but they also provide opportunities for recreation use. Decades ago, relatively few people sought wilderness experiences, and management problems were few and far between. Today, there are many places where the demand for recreation use cannot be met without significant impact to wilderness ecosystems and experiences (Cole and others 1997). Managers must seek a balance between the provision of access for visitors and protection from the problems associated with that visitation. They are challenged to find management approaches that maintain the sense of freedom, solitude, spontaneity, risk, and challenge that are considered fundamental to wilderness experiences. The ideal wilderness setting, where visitors have free access, experience minimal behavioral restrictions, and find undisturbed and uncrowded conditions is not always attainable. Managers must often choose among these desirable attributes. Resulting decisions—to deny access, restrict behavior, or allow further degradation—are always controversial.

Wilderness managers must deal with the fact that the types of people who visit wilderness come with very different expectations, motivations, desires, and abilities (Manning 1999). Some come for a few hours, while others come for weeks. Some ride horses while others hike. Some come in large groups while others come alone. In many cases, these differences result in serious conflict among user groups. Some places in wilderness, particularly unusually attractive locations close to trailheads, within close proximity to metropolitan areas, are heavily visited; other places seldom receive any visitation. One style of management simply cannot fit all these different situations.

To effectively manage wilderness recreation, managers need information that science can provide about wilderness visitors. Fortunately, there is a strong tradition of research about wilderness visitors. In fact, this is the wilderness research topic that has received the most attention from scientists since the early 1960s. Numerous studies have been conducted about who wilderness visitors are, the types of trips they take in wilderness, their behavior, knowledge, and experience and trends in these characteristics over time. Other studies have examined the motivations and preferences of visitors about desired wilderness experiences, as well as their evaluations of wilderness conditions and factors that influence the quality of experiences. Still others have examined how visitors and experiences have responded to changing wilderness conditions, particularly changes that have resulted from various management actions.

Another research tradition has been concerned with planning for and management of wilderness visitation. In the past, considerable attention was given to the concept of carrying capacity as a model for wilderness recreation planning. More recently interest has shifted to planning frameworks, such as Limits of Acceptable Change (McCool and Cole 1997), in which management strives to minimize the discrepancy between existing conditions and objectives, defined as measurable indicators and standards. This evolution has spurred increased interest in the development of indicators and standards for wilderness conditions. Monitoring and assessment procedures have become increasingly common. Among management approaches, education and the provision of information have received considerable attention. This level of interest probably reflects the potential for information to enrich experiences while simultaneously reducing both social and ecological impact problems (Roggenbuck 1992).

This volume is devoted to wilderness visitors and visitor management research. Visitor management must be based on more than information about visitors, however. The ecological effects of recreation use in wilderness must also be considered. Papers on this topic are included in a different volume in this proceedings—Wilderness Ecosystems, Threats and their Management.

The papers in this volume are organized into five sections. The first section contains three overview papers that span virtually the entire range of wilderness visitor research. Alan Watson describes how wilderness visitors have changed over time, with particular emphasis on his work and observations on the values of wilderness visitors and why values may have changed over time. Bob Manning and Dave Lime provide a broad overview of research on visitor experiences, with special emphasis on their carrying capacity and crowding research and its application to recreation management. Ed Krumpe discusses recreation planning models, with particular emphasis on experience with the application of Limits of Acceptable Change and related planning frameworks.

The second section in the volume contains a wide array of research papers on wilderness visitors. The diversity of papers included here are suggestive of the disparate topics that can provide useful insights about wilderness visitors. Some papers discuss the motivations, benefits, knowledge, acceptability judgments, and satisfaction of visitors, while others assess use levels, visitor behavior, displacement,

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conflict, and coping mechanisms. The third section is devoted to a set of research papers that are concerned with wilderness information and education. Visitor management is the topic of research papers included in the fourth section. Finally, the fifth section includes three papers that report on dialogue sessions that were held during the conference. These sessions dealt with wilderness education, group size issues and normative approaches to recreation management.

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1. Overviews

The Role of Science in Wilderness Planning—A State-of-Knowledge Review

Edwin E. Krumpe

Abstract—Wilderness planning has evolved since the Wilderness Act of 1964 in an atmosphere of intense debate and public scrutiny. Wilderness planning and the role science has played in developing the planning process has been influenced by many complex legal mandates, by thorny social issues, and by emerging planning paradigms. Wilderness planning has at times been inspired by scientific contributions to various elements of the emerging processes. However, seldom has it benefited from a sustained focus of scientific inquiry which would lead to progress through testing or improving the planning process or individual planning elements. Twelve ways that science could play an appropriate role in wilderness planning are described and strategies are suggested to help focus future scientific efforts.

Since the passage of the Wilderness Act of 1964 (U.S. Public Law 88-577) the United States has embraced the concept of identifying, protecting, and managing vast amounts of land in the National Wilderness Preservation System. Presently there are some 104 million acres protected in over 530 wilderness areas, or about 4.6% of the United States. Most of the political battles fought to protect and preserve these pristine landscapes have been lengthy and intensely debated, and the resulting legislation often includes compromises that pose problems for future management. It was early apparent that designation alone is not sufficient to protect and perpetuate the human and ecological values for which these areas have been designated. In fact, the Wilderness Act of 1964 defines wilderness as, "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions…" (Section 2. (c)). An ongoing program of management is necessary to deal with the human influences from both outside and within and their accompanying undesirable impacts. Along with the recognition that management was necessary, even in wilderness, came realization of the need to develop plans that would direct management toward long-range goals. In fact, it can be argued that the drive for passage of the Wilderness Act was spurred by the very lack of management and long-term planning afforded the original wild, wilderness and primitive areas designated under the L-20 regulations and the U-regulations of the Forest Service (Hendee and others 1990). Thus, the need for wilderness planning has been an integral part of wilderness management since the inception of the National Wilderness Preservation System.

This paper examines the role of science in wilderness planning, concentrating on the 1980s and 1990s. It will show that wilderness planning and the role of science in wilderness planning have been influenced by many complex legal mandates, by thorny social issues, by emerging planning paradigms and by the coevolution of several planning processes. Finally, a clarification of what role science could and should play in wilderness planning is presented.

Legislative History Affecting Wilderness Planning

Early wilderness plans exhibit several common characteristics. They were typically developed as stand-alone plans for the land area defined by the legally established wilderness boundaries. Although they focused primarily on managing recreational users and their associated impacts, often they were compartmentalized, reflecting natural resource disciplines, and addressed such things as grazing, water quality, fire management, vegetation or fish and wildlife. A manager or a concerned citizen could quite simply look to one document, the wilderness plan, to find a description of the resources, impending issues, on-the-ground-problems and proposed solutions and management direction for a particular wilderness. This did not last for long. Spurred by new and complex legal mandates, changes within the managing agencies, a focus on carrying capacity and the emerging demand for public participation, wilderness planning became increasingly complex and contentious.

Several new legal mandates (and the resultant implementation of policy and regulations) called for the concept of carrying capacity to be implemented by the federal agencies that manage wilderness (National Park Service, US Forest Service, Bureau of Land Management, and the US Fish and Wildlife Service). Cole and Stankey (1997) explain that in 1979, regulations implementing the 1976 National Forest Management Act (NFMA) specified that each national forest wilderness would "provide for limiting and distributing visitor use of specific portions in accord with periodic estimates of the maximum levels of use that allow natural processes to operate freely and that do not impair the values for which wildernesses were created" (Federal Register 1979). Similarly, since 1978, the General Authorities Act (U.S. Public Law 95-625) has required the National Park Service to develop "visitor carrying capacities" for each unit of the park system. This act requires all park units to have a general management plan and calls for "identification of implementation commitments for visitor carrying capacities for all areas of the unit."

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At the same time, implementation of the National Environmental Policy Act of 1969 (NEPA, Public Law 91-190) prescribed a process to develop environmental impact statements (EIS) for all major federal actions, and this has applied to wilderness plans since the 1980s. NEPA requires that environmental impacts be considered through an analysis of a proposed action and its alternatives, and that the public be allowed to comment on the actions under consideration. Although the EIS process was logical in conception, the legal challenges that often followed have resulted in a rather lengthy process that invites intense scrutiny by citizens and special interest groups. In effect, this has forced many wilderness planning processes to become subordinate to the EIS process required by NEPA, often to the detriment of good planning.

Changes within the managing agencies also affected the structure and approach to developing wilderness plans. In implementing the NFMA, the Forest Service established a policy that there would be only one, single forest plan for each national forest. Thus, all wilderness planning would either be subsumed in the forest plan or be relegated to merely making an amendment to the forest plan. This often further disappointed the public which was already disenchanted by the controversial forest planning process. Complicating matters was the fact that each of the four federal agencies that manage wilderness had quite different regulations and requirements for developing plans.

Furthermore, increasing disenchantment with resource management and government in general in the 1970s prompted new demands that a wider spectrum of citizens be given access to the decision-making process. This sentiment was reflected in the legislation of the period, especially the National Environmental Policy Act (NEPA) of 1969, the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), the National Forest Management Act (NFMA) of 1976 and the Federal Land Policy Management Act (FLPMA) of 1976, which outlined increased roles for public participation (Fazio and Gilbert 1986). How the public was invited to participate in the planning process, to what extent and when varied widely among federal agencies and even among wilderness planning efforts within each agency. While government entities often touted the benefits of citizen participation, many agencies were negligent in their efforts to include the public in decision making, or worse yet, offered only token avenues for participation. This inability or unwillingness to listen or respond to public comment resulted in a lack of trust and a sense of tokenism between the citizenry and government entities (McCoy and others 1995).

In summary, the course of wilderness planning has been rather chaotic, spurred more by outside pressures in a dynamic and changing society than by a systematic development of an optimal process. Consequently, science has played only a limited role in wilderness planning. Wilderness planning has sometimes been inspired by science, but rarely has scientific research focused directly on the planning process. Nevertheless, it is instructive to examine the underlying themes addressed by science, some defining characteristics of the context in which wilderness planning takes place today and the dominant planning frameworks that have emerged. These will provide insights into the future role of science in wilderness planning.

Underlying Suppositions That Affected Wilderness Planning

Burgeoning Recreational Use

Several underlying suppositions have influenced the evolution of wilderness planning and the role played by science. The first assumption to emerge was that the great surge in outdoor recreational use following the end of World War II would continue to grow, causing increasing impacts and related management problems in national forest and park wildlands. This assumption was fueled by America's population growth, which was characterized by an increasingly mobile society with more leisure time and discretionary income, improved access and improved equipment and marketing. Managers feared that this surge in use and the accompanying ecological and social impacts would jeopardize the essential wilderness qualities of naturalness and solitude that wilderness designation was mandated to perpetuate.

Recreation Carrying Capacity

The assumption of continued growth in use led managers and researchers to embrace the carrying capacity concept, which was one of the dominant concepts in natural resource management. Borrowed from range management and wildlife management, carrying capacity was defined as the maximum level of use an area can sustain within constraints imposed by natural factors of environmental resistance such as food, shelter or water. Beyond this natural limit, no major increases in the dependent population can occur (Stankey and others 1990). Recreation carrying capacity was simplistically considered the amount of use an area could tolerate without causing unacceptable damage to its resource and social conditions. Although never supported by empirical research, recreation carrying capacity was interpreted by managers and politicians to mean that a concrete number of users which an area could support could be empirically determined—exceeding this number would cause unacceptable impacts. Managers first enthusiastically embraced setting recreation carrying capacities on Western whitewater rivers where dramatic increases in boating use were causing noticeable instances of congestion and resource damage. This concept was so appealing that, with the impetus of the legal mandates mentioned above, most wilderness plans either explicitly or implicitly have focused on establishing recreational carrying capacities over the past 30 years. Recreation carrying capacity also became the central focus of most of the research that addressed wilderness management and planning during this period. Stankey and others (1990) state that an analysis of references dealing with carrying capacity revealed that from 1970 to 1990, over 2,000 papers had been published. Perhaps the most striking characteristic of this body of research is that no commonly accepted procedures emerged for applying the carrying capacity concept in the field (Graefe and others 1984). Scientific research provided some important insights which would greatly influence the direction wilderness planning would take in the 1990s.

First, a substantial body of research focused on the social and psychological experience recreationists seek in

wilderness, their perceptions of crowding and their judgments about the appropriateness of various management practices. It was concluded that different people seek different experiences in wilderness, and their judgement of quality varies with the experience being sought and the degree of environmental change deemed appropriate. In regards to carrying capacity, it was recognized that both the ecological capacity (defined by physical and biological dimensions) and the social capacity (defined by social psychological perceptions) had to be addressed. Recreational use could impact not only an area's physical-biological resources, such as vegetation and soils, but also the character of the recreational experience (Stankey and others 1990).

The second scientific insight was that the amount of use is only one of many variables that influence the quality of recreational experiences and ecological conditions. Many studies pointed out that the intensity of use is a poor indicator of total impact. Such things as the season of use, party size, length of stay, method of travel and behavior of the recreationists were often more important in explaining impact than the amount of use alone (Cole 1987; Hammitt and Cole 1987). Scientists initially concentrated on applying careful observation and research to determine the inherent value of the resource to sustain recreation use. Their failure to identify intrinsic limiting factors led to the realization that carrying capacity could only be determined through making value judgments that weighted resource and social impacts, along with human needs and values within the legal constraints of the Wilderness Act and enabling legislation.

Rational Comprehensive Planning Model

Another supposition was that natural resource management was predicated on the scientific precepts of rational, objective, unbiased observation and experimentation. Rationality, science and objectivity are regarded as the cornerstones of modern, scientific natural resource management. The role of science and research was elevated as an integral part of land use planning and decision making. Therefore, the wilderness management agencies adopted what they perceived to be rational and comprehensive planning models. These models relied heavily on the scientific approach to help identify issues, conduct inventory, analyze demands and needs, identify alternatives, evaluate alternatives, and subsequently monitor management practices. History shows that this approach did not lead to plans that were widely accepted, understood or trusted by the public. Rather, the public viewed planning as controlled by technocrats, engineers, economists and computer modelers, who produced plans the public neither understood nor trusted (Krumpe and McCool 1997). It may be an unfortunate historical footnote that the problem with these rational comprehensive plans is perhaps more attributable to the agencies' failure to help the public understand their inner workings than to some inherent flaw in the findings. Nevertheless, managers discovered that establishing recreation carrying capacity was not a technical problem, but rather a socio-political problem that involved making value judgments about what type and character of use were appropriate and how much impact to resource and social conditions would be tolerated. George Stankey (1997) sums this up:

> What became apparent early on was the need to recognize the significant, even predominant, political component of establishing limits on the use of public resources and the associated development of management strategies to implement those limits. Ultimately, the underlying questions of limitation, regulation, and management involved *choices*: about values (such as recreation use versus environmental protection), about the distribution of those values (such as, who gains versus who pays, such as between private and commercial users), and about the means through which the distribution of those benefits and costs were achieved (such as use limits, campsite closures).

Politicized Nature of Planning

A fourth realization was that wilderness planning takes place in a political marketplace, in which consensus and negotiation are every bit as important as scientific data and logic (Krumpe and Stokes 1993). Planners and managers began to recognize that dual conditions are required for effective planning. First, a technically sound planning process is required for explicitness and to facilitate the search for reasonable alternatives by systematically working through a logical sequence. This is a necessary, but not sufficient condition for effective planning. Managers now know that they also need a consensus among those affected by the plan about the proposed course of action. In the politicized settings in which wilderness planning takes place, the values in conflict are often well articulated, expressed and pursued by the various contending groups. The arena of conflict may shift over time, but it still encompasses the agency and its perceived mission. Indeed, one or several groups may in reality hold the power of implementation rather than the planning agency. This power, held in the political realm, is in practice "the power of veto" (Krumpe and McCool 1997).

Planners and wilderness managers often become frustrated when politics gets in the way of rational planning. They become frustrated when decisions are motivated more by political considerations than by purely biological or philosophical considerations of fairness, equity or other idealized values they hope would guide the management of publicly held natural resources. The public, on the other hand, experiences equal frustration at the significant effort going into planning that often results in no change, or in plans that do not address the needs of a particular interest. As a result, both managers and the public have become disillusioned that science does not, or often cannot, give them the facts they need to answer the thorny questions raised in wilderness planning. In fact, it has become a common delaying tactic in recent years for one group or another to simply question the legitimacy of (and thus dismiss) any science that runs counter to their values or expectations.

The value-laden nature of steps in the planning process has limited the role of science in wilderness planning in several ways. First, science has limited capacity to address disagreement over goals that are value-based. Almost always there is some disagreement over primary goals for individual wilderness areas—in other words, how wild should the wilderness be? The Wilderness Act of 1964 is a product of compromise hammered out over eight years of political wrangling; much of the act's language (such as "outstanding

opportunities for primitive and unconfined experiences") is still subject to different and conflicting interpretations by a variety of interest groups when discussing management of individual wilderness areas. Planners must address the following types of questions: What unique values or distinctive features and characteristics of the wilderness area should be perpetuated? Does the area contain outstanding ecological, scientific, recreational, educational, historic or conservation values, highlighted in legislation, that warrant special attention? Does the area provide critical habitat for threatened or endangered species? Do land uses or contiguous areas represent situations requiring special management attention? Are there existing or potential nonconforming uses in the area that will require special attention? How does the wilderness ecosystem and recreation opportunities fit in the regional context of natural resource management? What are the legislative acts, related legal guidelines and organizational policy that constrain management direction? These questions are important when identifying long-term goals, or desired future conditions, which is an essential first step in the planning process. Although science can be of assistance, these questions go beyond a mere inventory of features and existing conditions.

Limitations of Science to Provide Answers

A final supposition that arguably caused more harm than good was that science could directly provide the answers to solve the wilderness planning dilemma. To the contrary, over the past decade, managers and planners have come to realize that fundamentally planning occurs in an environment of uncertainty rather than rules or certainty. Among scientists there is legitimate disagreement over cause-effect relationships in wilderness. For example, there is often widespread disagreement over whether stocking game fish, or even recreational harvesting of fish, has a detrimental effect on the naturalness of wilderness conditions (Duff 1995; Murray 1994). Similar disagreement exists over goals and over cause-and-effect relationships concerning the use of pack stock, technical climbing (for example, using rock bolts and fixed anchors), airplane and powerboat access and their effects on biophysical attributes and conditions, and the effect of campers on wildlife species. Similarly, little is known about the cause-effect relationship in the spread of many exotic plant and animal species. For instance, spotted knapweed was initially thought to be spread in wilderness by pack stock but this is now questionable, given its ubiquitous infestation throughout the West, even in parts of wilderness areas which are inaccessible. Planners soon learned that addressing questions that were value-laden and for which there was no clear answer demanded more public participation and social learning. In these cases, resolution of the problem is more a function of negotiation than data collection and analyses.

Finally, science has been less than successful in giving managers answers to questions about monitoring and evaluating the implementation of wilderness management plans. There is little "science" that documents what indicators work well to detect change in many physical and social characteristics of wilderness conditions. For example, there is scant research to tell us what indicator is best to use to monitor trampling impacts caused by recreation pack stock. Should we measure soil compaction? Increased or decreased soil surface roughness? Depth of hoof prints? Soil moisture? Area of trampling? Plant damage? Seedling damage? Shift in species composition? Changes in plant vigor? Likewise, indicators of social conditions are often ambiguous, at best. Specific questionnaire items from social science studies are commonly taken out of context and used as social indicators, to deal with such things as, "overall satisfaction," "perceived crowding," "encounter levels" and "solitude."

Emergence of Dominant Planning Frameworks

The preceding discussion has painted a rather negative picture of the role of science in wilderness planning. For two decades managers clung to the notion that scientific and technically astute investigation could provide the necessary answers to produce better wilderness plans. As they learned that there are important limitations to the application of science to wilderness planning problems they began to look for alternative approaches. What emerged, beginning in 1978, were five dominant wilderness planning frameworks. These are commonly referred to by their acronyms: ROS (recreation opportunity spectrum), LAC (limits of acceptable change), VIM (visitor impact management), VAMP (visitor activities management) and eventually in 1993, VERP (visitor experience and resource protection). For a comprehensive review and comparison, the reader is referred to Nilsen and Tayler (1997).

The seminal framework was the ROS, which reflected advances in recreation research that posited that people seek to engage in recreation activities in preferred physical, social and managerial settings to realize desired psychological experiences and benefits (Clark and Stankey 1979; Driver and Brown 1978). It proposed that landscapes could be inventoried and classified into distinct categories, each capable of providing a different type of recreation opportunity. These ranged from the most primitive to the most developed or urban outdoor recreation opportunities and were initially labeled primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural and urban. The contribution to wilderness planning was the concept that the wilderness (or primitive) experience was based on maintaining suitable biophysical settings of naturalness (that is, essentially unmodified natural environments of large size and remoteness), social setting conditions of solitude (very low concentration of users, absence of evidence of other users) and a managerial setting that provides freedom from intrusive regulation. The ROS explicitly recognized that recreation experiences are related to the settings in which they occur and that settings are a function of environmental, social and managerial factors which mangers should address in the wilderness planning process (Manning 1986).

The limits of acceptable change (LAC) planning process was developed specifically to address wilderness recreation planning (Stankey and others 1985) and as an alternative model for making decisions about carrying capacity, by making explicit the value judgments about appropriate types and levels of use and their management. It explicitly recognized that all recreational use of wilderness causes

some impacts, but a limit should be placed on the amount of change to be tolerated (Stankey 1997). At the core of the nine-step process were the selection of indicators of change, the development of standards, the assessment of current conditions through inventory and monitoring and the formulation and implementation of management prescriptions to bring conditions into compliance with standards. The LAC process recognized the predominant political component of establishing limits on the use of public resources.

From its first application in the Bob Marshal Wilderness, the transactive planning model was adopted as the framework that would guide public involvement, collaboration and consensus building. This model, based on the work of John Friedmann (1973a; 1973b), argued that dialogue among stakeholders was a necessary component of planning and that the scientific experts and public stakeholders should interact on equal footing to produce the plan (Stokes 1990). LAC is a specific planning process, separate from the transactive or collaborative processes utilized in many of its applications. By 1992, the LAC process had become the most widely applied wilderness planning process in America, reportedly used by 92% of fifty western national forests that contain 116 wilderness areas (McCoy and others 1995). A full discussion of the development, application and evolution of the LAC process can be found in two proceedings published in 1986 and 1997 (Lucas 1986; McCool and Cole 1997).

Two somewhat similar planning processes were developed in conjunction with the National Park Service, VIM (visitor impact management) in 1990 and VERP (visitor experience and resource protection) in 1993 (Graefe and others 1990; Hof and Lime 1997). Both were developed to address the mandate to determine carrying capacity in national parks in both front country (accessible by road and offering visitor amenities) and backcountry (accessible by trail and offering only primitive camping) comparable to wilderness. VIM addresses three basic issues relating to impact: problem conditions, potential causal factors and potential management strategies. VERP is a new framework that deals with carrying capacity in terms of the quality of the resources and the quality of the visitor experience. It produces a prescription for desired future resource and social conditions, defining what levels of use are appropriate, where, when and why (Nilsen and Tayler 1997).

Created by Parks Canada, the Management Process for Visitor Activities (VAMP) was developed in 1985 and incorporates the principles of ROS to assess visitor opportunities, analyzing both opportunities and impacts. Its emphasis is on identifying heritage themes, resource capability and suitability, appropriate visitor activities and alternative visitor activity concepts for these settings.

Common Strengths and Weaknesses of the Planning Frameworks

VERP, VIM, VAMP and LAC are conceptually more similar than different, in that they all propose to address questions of carrying capacity, appropriate visitor use and biophysical and social impacts caused by recreation use. While each framework calls for its own steps and procedures, they all address both environmental and social (experiential) conditions and call for development of future management direction, such as goals, objectives or desired future conditions (Hof and Lime 1997). All recognize that a combination of biological, social and managerial conditions defines what kind of recreation experience a place can offer. All involve a hierarchy of decisions: inventory, strategic zoning, implementation and monitoring strategies. All focus on management of human-induced change and call for utilization of natural science and social science data. All include provisions for public involvement to greater or lesser degrees. All identify factors, indicators and standards which are measurable attributes of resource and social conditions (implicitly borrowed from management-by-objectives planning), and all call for ongoing monitoring and evaluation.

These planning frameworks have made many advances in attempting to address recreation carrying capacity in a more holistic fashion, by maintaining desired future conditions rather than just limiting numbers of visitors. Nevertheless, some common shortcomings of wilderness planning have been fairly pervasive and should be pointed out. These will serve as a springboard for discussion of what the role for science should be in the future and what some of the next steps should be. The following are nine weaknesses exhibited by many wilderness plans over the years.

- A primary, almost exclusive focus on recreation. Recreation use is obviously an introduced variable in the wilderness setting that is known to produce undesirable impacts. However, many other things that can detract from pristine natural qualities are often overlooked. Outside vectors, such as anthropogenic air pollution, mechanical noise pollution, loss of flora and fauna species, loss of primary predators, accumulation of fuels and change in species composition from fire suppression, changes in water quality and flow regimes from rivers and streams that flow into wilderness and impacts from only partial protection of habitats, are examples of many impacts that could potentially cause greater long-term change in pristine natural conditions than most recreation impacts.
- Failure to address biophysical components of the ecosystem in any but a most cursory manner.
- The quest for over 20 years to empirically determine a concrete carrying capacity, in terms of the appropriate number of visitors.
- Failure to articulate specific desired future conditions or long-term goals in any but the most general of terms.
- Being issue-driven rather than goal-driven. Although plans must address issues that are important to the public, focusing on issues tends to be negative and pits user groups against one another. This misdirects too much attention to the most current or inflammatory issue rather than the issues that may have the most impact on the health of the wilderness ecosystem .
- Inadequate inventory data of all kinds. Both managers and the public become frustrated when they discover how little data have been collected prior to starting the plan, how limited in scope it is, how unreliable it often is, and how expensive and time consuming it will be to collect additional data to address pressing management questions.
- The lack of support and involvement from higher levels of management in the planning process.

- Failure to follow through and systematically complete things that were articulated in the plan.
- Last-minute changes by upper level administrators who were not involved in the planning process or knowledgeable about the compromises and tradeoffs that were considered and agreed upon.

What Is the Role for Science?

The preceding discussion has enumerated the many problems and shortcomings of wilderness planning. A central argument is that although science has perhaps inspired various elements of wilderness planning, it has seldom specifically focused on testing or improving the process or the individual elements before adopting a new approach. This does not need to be the case in the future. The following presentation discusses how science could contribute to better wilderness planning by addressing specific elements and process variables.

Inventory and Description

Managers often have only limited inventory data, often of questionable quality or reliability. The best science and newest techniques and protocols should be used to conduct better inventories, surveys and samples in wilderness. For instance, collecting DNA from animal hair or droppings can reveal not only which species are present, but can also identify individual animals within the species. This is much less invasive than the typical radiotelemetry techniques, which require capture, handling, collaring and recapture of the animals.

Problem Detection

Science should play a key role in identifying the presence and direction of change in wilderness conditions. Arguably, scientists are better equipped than the public to detect subtle changes in biophysical and social conditions to assess the rate of change and even determine probable consequences to other elements of the wilderness resource. This could greatly supplement the common practice of placing too much reliance on the issues generated by public input.

Research on Cause and Effect

Scientists have done a lot to identify impacts, categorize them and measure them after they have taken place (Cole and Landres 1996). However, very little research has been done to discover how the impacts actually occur. For instance, we commonly measure damaged trees associated with campsites. But we do not know what behaviors or conditions augment or suppress this damage, at what rate it occurs, by which types of users, by how many users or in what season it primarily occurs. The same could be said for cutting trail switchbacks, defacing cultural artifacts, trampling stream banks and even littering.

Understanding the Limitations of Data

Members of the public, managers and planners often do not know how to interpret scientific data and reports. In particular, they often are not knowledgeable about the adequacy of sampling and the limitations of various research methods, and they do not understand how to interpret margins of error, confidence limits or levels of statistical significance. Scientists could do wilderness planning a great benefit by teaching people more about how to interpret data and how to understand the limitations of the data.

Development of Monitoring Protocols

Monitoring data are only as good as the methods used to collect them. Scientists could contribute in two ways. First, they need to explain the methods, sampling schemes and collection protocols that were followed to collect any data that they provide to planners or managers. Second, they need to conduct research specifically aimed at testing and improving protocols for monitoring biophysical and social conditions in wilderness. Furthermore, whenever possible, scientists should develop and test the most simple and straightforward means of data collection possible because experience has shown that when sophisticated equipment and complicated analyses are required, the probability is high that the method will not be maintained in the field by management personnel.

Development of Long-Term Databases

Managers seldom have the ability to collect and maintain databases over the long term. Turnover in personnel, shifts in funding and staffing levels, availability of trained personnel, lack of understanding of how to manipulate, query or analyze the database and lack of understanding of the need for rigor in following data collection protocols are some of the reasons why managers are ill-suited to maintain long-term databases. Rich rewards could accrue from developing long-term databases in the world's most pristine natural environments—the wildernesses of America.

Search for Key Ecosystem Indicators

Scientists need to continue to search for sensitive species or ecosystem characteristics that should be monitored to detect changes in natural conditions. Specifically, indicators that are sensitive to human use, change early in response to initial impacts or foretell more serious damage should be identified and tested.

Search for Robust Social Indicators

Similarly, social scientists need to focus on identifying human factors that are sensitive to the loss or deterioration of the wilderness experience or loss of wilderness conditions. For example, to what extent is visitor displacement a problem in park and wilderness settings, and what social or physical impacts are responsible for displacement? Refining

measurement instruments and collection techniques for social indicators would also be beneficial to wilderness planners.

Assist in Monitoring the Effectiveness of Various Management Practices

A major outcome of the wilderness planning frameworks is the prescription of management strategies to maintain desired wilderness conditions. All too often, management practices are implemented with little knowledge about how effective the practices are. Likewise, managers seldom determine whether or how conditions are actually improving once the practices are implemented. Applying the scientific method would greatly assist in measuring the effectiveness of various management practices.

The preceding recommendations have focused primarily on the role science should play in wilderness planning by contributing to better monitoring practices. Science should also contribute to better wilderness planning by studying various aspects of the planning process itself. Three recommendations follow.

Evaluation of the Effectiveness of Different Planning Processes

A huge body of knowledge exists about evaluation research and, more particularly, social program evaluation. These research methods can be applied to park and wilderness management processes—for example, see Ham (1986) or Ashor and others (1986). Planners and managers are constantly seeking and trying new ways to conduct various parts of the planning process. These trials should be viewed as field experiments, and scientific methods should be utilized to evaluate their effectiveness.

Case Study Research on Different Wilderness Planning Applications

Research on actual planning processes is difficult because scientists cannot control the manipulation of variables during the process. Alternate qualitative research methods and case study research approaches should be applied to understand such things as the rich interplay of participants, the effectiveness of various public involvement techniques, how tradeoffs are evaluated and how compromises and consensus decisions are made.

Move From Anecdotal Descriptions to Comparative Analyses and Hypotheses Testing

Much of the literature about wilderness planning has appeared in conference proceedings and consists primarily of anecdotal descriptions and discussions. This has been of limited help to other planners. Although it is difficult to do, scientists could contribute much to wilderness planning by conducting more comparative analyses of plans that used the same (or different) planning processes. A clearer understanding should be sought of what conditions and circumstances contribute to successful (and unsuccessful) planning programs. This could lead to field experimentation applying different techniques and testing hypotheses. The result would be a better understanding of the various strengths and shortcomings of planning processes.

Next Steps for Science in Wilderness Planning

The past three decades have witnessed an amazing growth in wilderness designations in the United States and a corresponding increase in the time and effort devoted to producing wilderness plans. Buffeted by societal changes, demands for citizen participation and complex new legal mandates for natural resource management, wilderness planning has at times been inspired by science. But seldom has it benefited from a sustained focus of scientific inquiry. If science in general is going to continue to make positive contributions to wilderness planning, several strategies are necessary.

First, there should be greater collaboration across disciplines. Wilderness areas span complex ecosystems, with diverse and highly concerned constituencies. It is counterintuitive to assume that one or more scientists trained in a single discipline could make as large a contribution as a team of scientists who work together to collaborate across different disciplines. For example, scientists investigating the impacts of deteriorating air quality would likely reach greater insights if they examined the interrelated impacts on visitors, soil, water, fish reproduction, macroinvertebrates, lichens and moss, insects and wildlife. Likewise, closer collaboration between scientists and managers would be mutually beneficial. Managers have an intimate understanding of many things that would be beneficial to scientists in the field, such as trail conditions, stream levels, remote sites, game trails, historic conditions and so forth. Scientists who have spent days and weeks in the backcountry often gain insights that escape managers, who must focus their attention on travel corridor upkeep, campsite restoration and other daily management problems.

Another beneficial strategy would be to implement carefully planned research demonstration projects and pilot management projects with heavy scientific involvement. This idea is not new. Concepts underlying the ROS and LAC process were demonstrated in the Maroon-Bell Snowmass Wilderness in Colorado in the early 1980s (Stokes 1991). Demonstration projects that featured collaboration across scientific disciplines could test new ideas and promote deeper understanding.

Another old idea whose time has come is the development of large, shared databases that include input from scientists, from both social and natural science disciplines, from parks and wilderness areas and from all four federal management agencies. This has already begun through the Aldo Leopold Wilderness Research Institute. However, with the advent of improved Internet access (and soon the super high-speed Internet2) the entire database could be made instantly accessible to any scientist or manager. What needs to be

developed is thoroughly user-friendly, front-end software to facilitate interactive live searches and exploration of the data over the Internet.

Finally, we need to work together to ensure the seamless integration of science, planning and management with an informed and involved public. Scientists should assume a pivotal role because they have the unique opportunity of playing the dual role of investigator and educator, collecting and interpreting data that is relevant and useful to planners, managers and citizens alike. As we move into the new millennium, scientists will have the unique opportunity and ability to help educate professionals and laymen to use, appreciate and apply scientific information to enhance future wilderness planning processes.

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Defining and Managing the Quality of Wilderness Recreation Experiences

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Abstract—There is a substantial body of scientific literature on defining and managing the quality of wilderness experiences. Two conceptual frameworks derived from this literature—carrying capacity and the Recreation Opportunity Spectrum (ROS)—suggest that wilderness recreation experiences can be defined through indicators and standards of quality, and that wilderness recreation should be managed to ensure that standards of quality are sustained over time. This paper briefly describes the conceptual frameworks of carrying capacity and ROS; reviews the growing literature on wilderness-related indicators and standards of quality, and wilderness recreation management; and suggests a number of issues that warrant further research and management attention.

The Wilderness Act, along with the organic legislation creating the four federal wilderness management agencies, prescribes multiple objectives of wilderness. One of the principal objectives of this legislation is to provide outdoor recreation opportunities. Passage of the Wilderness Act in 1964 marked the beginning of a period of intensive research on outdoor recreation in wilderness and related areas, and this research has given rise to a substantial body of scientific literature on defining and managing the quality of wilderness experiences.

While the literature on wilderness recreation is diverse, several conceptual frameworks have evolved that help integrate and synthesize information from recreation research. Two traditional frameworks are carrying capacity and the Recreation Opportunity Spectrum (ROS). Both of these frameworks suggest that wilderness and related outdoor recreation experiences can be defined through indicators and standards of quality, and that wilderness recreation should be managed to ensure that standards of quality are sustained over time.

This paper uses the above conceptual frameworks and approaches to review and synthesize the literature on defining and managing wilderness and related outdoor recreation experiences. The conceptual frameworks of carrying capacity and ROS are briefly reviewed in the first section to trace the evolution and contemporary emphasis on indicators and standards of quality and related wilderness recreation management practices. The next two sections review the growing literature on wilderness-related indicators and standards of quality and wilderness recreation management. A final section suggests a number of issues that warrant further research and management attention.

This paper takes an expansive approach to reviewing the literature on management of wilderness and related areas for recreation experiences. Studies included in this review focus on both designated wilderness areas and areas that might be described as wilderness with a lower case "w." The intent is to identify principles, concepts and patterns that can be synthesized from the growing scientific literature on defining and managing wilderness-related recreation experiences.

Wilderness Recreation Management Frameworks

Carrying Capacity

Rapidly expanding recreation in the 1950s and 1960s gave rise to concerns over acceptable use levels of wilderness and related outdoor recreation areas. While interest in the impacts of recreation on the natural resource base predominated, there was also emerging interest in the effects of increased use on the quality of the recreation experience. Early studies prompted theorists to search for a way such issues might be fit into an organizational framework to help formulate outdoor recreation policy. A resulting paradigm was the concept of carrying capacity.

The first rigorous application of carrying capacity to outdoor recreation came in the early 1960s with a conceptual monograph (Wagar 1964) and a preliminary empirical treatment (Lucas 1964). Perhaps the major contribution of Wagar's conceptual analysis was the expansion of carrying capacity from its dominant emphasis on environmental effects to a dual focus that included social or experiential considerations:

> The study reported here was initiated with the view that the carrying capacity of recreation lands could be determined primarily in terms of ecology and the deterioration of areas. However, it soon became obvious that the resource-oriented point of view must be augmented by consideration of human values (Wagar 1964, preface).

Wagar's point was that as more people visit a wilderness or related recreation area, not only the environmental resources of the area are affected, but also the quality of the recreation experience. Thus, carrying capacity was expanded

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to include consideration of the social environment as well as the biophysical environment. The effects of increasing use on recreation quality were illustrated by means of hypothetical relationships between increasing use level and visitor satisfaction. This analysis suggested that the effects of crowding on satisfaction would vary, depending on visitor needs or motivations.

A preliminary attempt to estimate the recreation carrying capacity of the Boundary Waters Canoe Area, in Minnesota, followed shortly, and it found that perceptions of crowding varied by different user groups (Lucas 1964). Paddling canoeists were found to be more sensitive to crowding than motor canoeists, who were in turn more sensitive to crowding than other motorboaters. A range of carrying capacities was estimated depending on these different relationships.

Limits of Acceptable Change—Carrying capacity has attracted intensive focus as a research and management concept in wilderness recreation. Several bibliographies, books and review papers have been published on carrying capacity and related issues, and these publications contain hundreds of citations (for example, Graefe and others 1984; Kuss and others 1990; Shelby and Heberlein 1986; Stankey and Lime 1973; Stankey and Manning 1986). Despite this impressive literature base, efforts to apply carrying capacity to wilderness and related outdoor recreation areas has often resulted in frustration. The principal difficulty lies in determining how much impact or change should be allowed within each of the components that make up the carrying capacity concept: biophysical resources and the quality of the recreation experience.

The growing research base on wilderness recreation indicates that increasing visitor use often causes impact or change. This is especially clear with biophysical resources. An early study in the Boundary Waters Canoe Area, for example, found that an average of 80% of ground cover vegetation was destroyed at campsites in a single season, even under relatively light levels of use (Frissell and Duncan 1965). The biophysical and ecological impacts of outdoor recreation have been summarized and synthesized in a number of studies (for example, Cole 1987, Kuss and others 1990, Hammitt and Cole 1998), including a companion paper by Leung and Marion in this volume. Research also suggests that increasing visitor use can change the quality of the recreation experience through crowding, conflict and other impacts. This issue is often referred to as the "limits of acceptable change" (Frissell and Stankey 1972). Some change in the biophysical and social environments of wilderness recreation is inevitable, but sooner or later, the amount, nature or type of change may become unacceptable. But what determines the limits of acceptable change?

This issue is illustrated graphically in figure 1, which shows a hypothetical relationship between visitor use and impacts to the biophysical and social environments. This relationship suggests that increasing wilderness use can and often does increase impacts, in the form of damage to fragile soils and vegetation, and crowding and conflicting uses. However, it is not clear from this relationship at what point carrying capacity has been reached. For this relationship, X1 and X2 represent alternative levels of visitor use that result in corresponding levels of impact, as defined by points Y1 and Y2, respectively. But which of these points—Y1 or Y2,

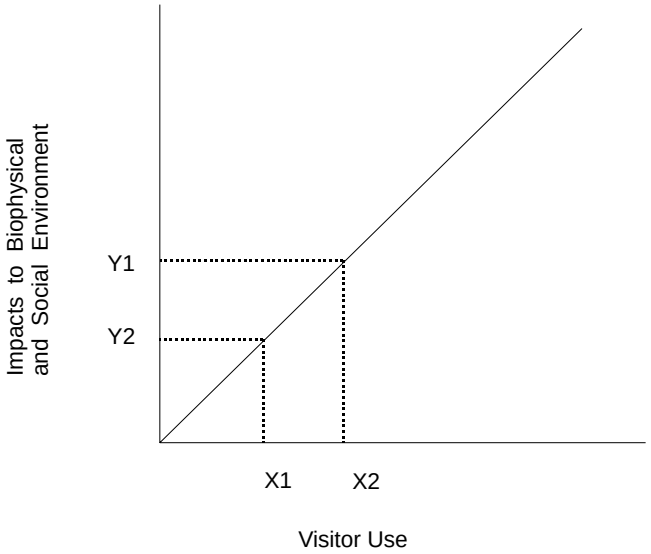

Figure 1—Hypothetical relationship between visitor use and impact to the biophysical and social environments (from Manning and Lime 1996).

or some other point along the vertical axis—represents the maximum amount of impact that is acceptable?

To emphasize and further clarify this issue, some studies have suggested distinguishing between descriptive and prescriptive components of carrying capacity (Shelby and Heberlein 1984, 1986). The descriptive component of carrying capacity focuses on factual, objective data such as the relationship in figure 1. For example, what is the relationship between the amount of visitor use and perceived crowding? The prescriptive component of carrying capacity determination involves the seemingly more subjective issue of how much impact or change in the recreation environment is acceptable. For example, what level of perceived crowding should be allowed?

Indicators and Standards of Quality—Recent experience with carrying capacity suggests that answers to the above questions can be found through formulation of management objectives and associated indicators and standards of quality (Boteler 1984; P. Brown 1977; Bury 1976; Frissell and Stankey 1972; Graefe and others 1990; Lime and Stankey 1971; Lime 1977a, 1979, 1995; Lucas and Stankey 1974; Manning and others 1995a, 1995c; Manning and Lime 1996; Manning and others 1996b,e; Manning 1997; National Park Service 1997; Shelby and others 1992b; Shindler 1992; Stankey 1980b; Stankey and others 1985; Stankey and Manning 1986). This approach to carrying capacity focuses on defining the type of visitor experience to be provided. Management objectives are broad narrative statements defining the type of visitor experience to be provided. Indicators of quality are more specific, measurable variables reflecting the essence or meaning of management objectives. They are quantifiable proxies or measures of management objectives. Indicators of quality may include elements of the biophysical, social and management environments that are important in determining the quality of the visitor experience. Standards of quality define the minimum acceptable condition of indicator variables.

An example may help illuminate these ideas and terms. Review of the Wilderness Act of 1964 suggests that areas contained in the National Wilderness Preservation System are to be managed to provide opportunities for visitor solitude. Thus, providing opportunities for solitude is an appropriate management objective for most wilderness areas. Moreover, research on wilderness use suggests that the number of other visitors encountered along trails and at campsites is important in defining solitude for wilderness visitors. Thus, trail and camp encounters are potentially good indicators of quality. Research also suggests that wilderness visitors may have normative standards about how many trail and camp encounters can be experienced before opportunities for solitude decline to an unacceptable degree. For example, a number of studies suggest that wilderness visitors prefer to see no more than three to five other groups per day along trails. Thus, a maximum of five encounters per day with other groups along trails may be a good standard of quality.

Carrying Capacity Frameworks—The literature described above has given rise to several frameworks for determining and applying carrying capacity to wilderness and related outdoor recreation areas. These frameworks include Limits of Acceptable Change (McCool and Cole 1997a; Stankey and others 1985); Visitor Impact Management (Graefe and others 1990), Visitor Experience and Resource Protection (Hof and Lime 1997; Manning and others 1996b; National Park Service 1997), Carrying Capacity Assessment Process (Shelby and Heberlein 1986), Quality Upgrading and Learning (Chilman and others 1989, 1990) and Visitor Activity Management Process (Environment Canada and Park Service 1991). All of these frameworks incorporate the ideas about carrying capacity described above and provide a rational, structured process for making carrying capacity decisions.

The basic steps or elements of the three most widely applied carrying capacity frameworks are shown in table 1. While terminology, sequencing and other aspects may vary among these frameworks, all share a common underlying logic. Core elements of these frameworks include:

1. Definition of the types of recreation opportunities to be provided. Recreation opportunities should be defined as specifically and quantitatively as possible through indicators and standards of quality.
2. Management action designed to sustain standards of quality over time. When standards of quality are in danger of being violated, management intervention is required.

Several applications and evaluations of these carrying capacity frameworks and related processes are described in the literature (Absher 1989; Ashor and others 1986; Graefe and others 1986; Graefe and others 1990; Hof and others 1994; Kaltenborn and Emmelin 1993; Manning and others 1995a,b,c; Manning and Lime 1996; Manning and others 1996b,c; Manning 1997; McCool and Cole 1997b; McCoy and others 1995; Ritter 1997; Shelby and Heberlein 1986; Warren 1997; Vaske and others 1992).

The Recreation Opportunity Spectrum (ROS)

Diversity in Outdoor Recreation—Many studies have been conducted of visitors to wilderness and related outdoor recreation areas over the past several decades. The objectives,

Table 1—Carrying capacity frameworks.

Limits of acceptable change	Visitor impact management	Visitor experience and resource protection
Step 1. Identify area concerns and issues	Step 1. Pre-assessment data base reviews	Element 1. Assemble an interdisciplinary project team
Step 2. Define and describe opportunity classes	Step 2. Review of management objectives	Element 2. Develop a public involvement strategy.
Step 3. Select indicators of resource and social conditions	Step 3. Selection of key impact indicators	Element 3. Develop statements of primary park purpose, significance, and primary interpretive themes.
Step 4. Inventory resource and social conditions.	Step 4. Selection of standards for key impact indicators.	Element 4. Analyze park resources and existing visitor use.
Step 5. Specify standards for resource and social indicators.	Step 5. Comparison of standards and existing conditions.	Element 5. Describe a potential range of visitor experiences and resource conditions.
Step 6. Identify alternative opportunity class allocations.	Step 6. Identify probable causes of impacts	Element 6. Allocate potential zones to specific locations
Step 7. Identify management actions for each alternative.	Step 7. Identify management strategies	Element 7. Select indicators and specify standards for each zone; develop a monitoring plan.
Step 8. Evaluation and selection of an alternative.	Step 8. Implementation	Element 8. Monitor resource and social indicators.
Step 9. Implement actions and monitor conditions.		Element 9. Take management action.

scope and methods of these studies are highly variable, but at least one general finding has been pervasive: Wilderness and related outdoor recreation are diverse. This is a recurring theme, whether in regard to recreation activities, socioeconomic and cultural characteristics of visitors, attitudes about policy, preferences for services and facilities, sensitivity to crowding and conflict, experience level, and motivations for and benefits received from recreation participation. Diversity in tastes for outdoor recreation is found equally in studies of developed campgrounds and investigations of wilderness hikers.

Research points out that not only are there differences in taste among people, but that people's tastes change over time as well (Burch 1966). A study in the Pacific Northwest, for example, found that the type of camping chosen (wilderness camping, automobile camping or some combination of the two) was strongly related to changes in stage of the family life cycle. A nationwide panel study of campers found similar relationships between camping activity and family life cycle (LaPage 1973, LaPage and Ragain 1974). Based on these relationships, it has been suggested that outdoor recreation "is like an omnibus—the seats are often full but often occupied by different persons as they adjust to the flow of time" (Burch 1966).

ROS—ROS is a conceptual framework for encouraging diversity in wilderness and related outdoor recreation opportunities. Relationships among site factors that combine to define recreation opportunities are arranged in configurations that suggest categories of opportunities. ROS has been adopted by two wilderness management agencies, the U.S. Forest Service and the Bureau of Land Management (Buist and Hoots 1982; Driver and others 1987). ROS was developed simultaneously by two groups of researchers: Clark and Stankey (1979) and Brown, Driver, and associates (P. Brown and others 1978; P. Brown and others 1979; Driver and Brown 1978).

ROS recognizes four levels of demands for recreation—(1) activities, (2) settings, (3) motivations, and (4) ultimate benefits, and the focus is on level 2 demands-settings. Brown, Driver and associates take a more empirically oriented approach to ROS, seeking to link settings to the motivations or psychological outcomes they fulfill. Clark and Stankey (1979) take a more applied approach. They note that as knowledge of linkages between recreation settings and psychological outcomes improves, so does the efficacy of meeting visitor demands. In the meantime, managers should emphasize the provision of diversity in recreation settings, based on the assumption that a corresponding diversity of experiences will be produced.

ROS also recognizes that wilderness and related recreation settings are defined by three broad categories of factors: environmental, social and managerial. By describing ranges of these factors, selected types of recreation opportunities can be defined. Clark and Stankey (1979) are most specific in defining these factors and the resulting recreation opportunity types. They suggest that six basic factors—access, nonrecreational resource uses, on-site management, social interaction, acceptability of visitor impacts and acceptable regimentation—be used to define the opportunity spectrum.

P. Brown and others (1978) take a more narrative or descriptive approach to defining recreation opportunity types. Six opportunity classes are identified; for each recreation opportunity class, the associated experience provided and the physical, social and managerial settings are described. Five specific factors are used to define and distinguish among recreation opportunity classes: managerial regimentation, interaction among user groups, evidence of human modification of the environment, size or extent of area of opportunity and remoteness.

Defining and Managing Wilderness Recreation

Carrying capacity and ROS provide useful frameworks for integrating and synthesizing much of the social science literature on wilderness and related outdoor recreation. Taken together, they suggest a basic approach to defining and managing wilderness experiences. First, wilderness experiences can be defined through indicators and standards of quality. Indicators and standards of quality can be formulated for the resource, social and managerial components of wilderness recreation opportunities. Second, management action is needed to sustain standards of quality over time. If standards of quality are not maintained, wilderness experiences will change in unknown and perhaps undesirable ways. The next two sections of this paper review the wilderness and related recreation literature that addresses indicators and standards of quality of wilderness experiences and management of wilderness recreation.

Defining Wilderness Recreation: Indicators and Standards of Quality

The previous section described the way in which indicators and standards of quality have emerged as a central focus of contemporary wilderness recreation management frameworks. But how are indicators and standards of quality formulated? Moreover, what indicators and standards of quality have been suggested in the research literature?

Research on crowding in outdoor recreation suggests of an important approach to formulating indicators and standards of quality. Crowding can be understood as a normative process. That is, wilderness visitors often have preferences, expectations or other standards to judge a situation as crowded or not. In fact, research demonstrates that such standards are often more important in crowding judgments than the number of other groups encountered (Manning 1985; Shelby and Heberlein 1986). If such standards can be defined and measured, they may be useful in formulating indicators and standards of quality for wilderness recreation.

This section of the paper describes the application of normative theory and methods to the formulation of indicators and standards of quality. Characteristics of good indicators and standards of quality are outlined, examples of indicators and standards of quality are compiled and presented, and a series of conclusions from this research are

developed and discussed. Finally, a series of theoretical and methodological issues are identified regarding application of the normative approach to indicators and standards of quality in wilderness and related outdoor recreation.

Norm Theory and Methods

Developed in the disciplines of sociology and social-psychology, normative theory and related empirical methods have attracted substantial attention as organizing concepts in wilderness and related outdoor recreation research and management (Heberlein 1977; Shelby and others 1996; Shelby and Heberlein 1986; Vaske and others 1986, 1992, 1993). Much of this literature has been organized around the work of Jackson (1965), who developed a methodology for measuring norms. Adapting these methods to outdoor recreation, visitors can be asked to evaluate alternative levels of potential impacts caused by increasing recreation use levels or changing types of recreation use. For example, visitors might be asked to rate the acceptability of encountering increasing numbers of recreation groups while hiking along trails. Resulting data would measure the personal crowding norm of each respondent. These data can then be aggregated to test for social crowding norms, or the degree to which norms are shared across groups such as first-time versus experienced hikers.

Social norms can be illustrated graphically, as shown in figure 2. Using hypothetical data associated with the example described above, this graph plots average acceptability ratings for encountering increasing numbers of visitor groups along trails. The line plotted in this illustration is sometimes called an "encounter" or "contact preference curve" (when applied to crowding-related variables), or it might be called an "impact acceptability curve" more generally, or simply a "norm curve."

Norm curves like the one in figure 2 have several potentially important features or characteristics. First, all points along the curve above the neutral line—the point on the vertical axis where evaluation ratings fall from the acceptable into the unacceptable range—define the "range of acceptable conditions." All of the conditions represented in this range are judged to meet some level of acceptability by about half of all respondents. The "optimum condition" is defined by the highest point on the norm curve. This is the condition that received the highest rating of acceptability from the sample as a whole. The "minimum acceptable condition" is defined as the point at which the norm curve crosses the neutral line. This is the condition that approximately half of the sample finds acceptable and half finds unacceptable. "Norm intensity" or norm "salience"—the strength of respondents' feelings about the importance of a potential indicator of quality—is suggested by the distance of the norm curve above and below the neutral line. The greater this distance, the more strongly respondents feel about the indicator of quality or the condition being measured. High measures of norm intensity or salience suggest that a variable may be a good indicator of quality because respondents feel it is important in defining the quality of the recreation experience. "Crystallization" of the norm concerns the amount of agreement or consensus about the norm. It is usually measured by standard deviations or other measures of variance of the points that describe the norm curve. The less variance or dispersion of data around those points, the more consensus there is about social norms. Norm curves are sometimes constructed with the vertical axis of the graph representing the percentage of respondents who report each level of impact as the maximum acceptable.

Norms can also be measured using a shorter, open-ended question format by asking respondents to report the maximum level of impact that is acceptable to them. In the example illustrated in figure 2, respondents could simply be asked to report the maximum number of groups they would find acceptable while hiking along trails during a day's time. This format is designed to be less burdensome to respondents, but it also yields less information. Alternative question formats for measuring norms are addressed more fully later in this section.

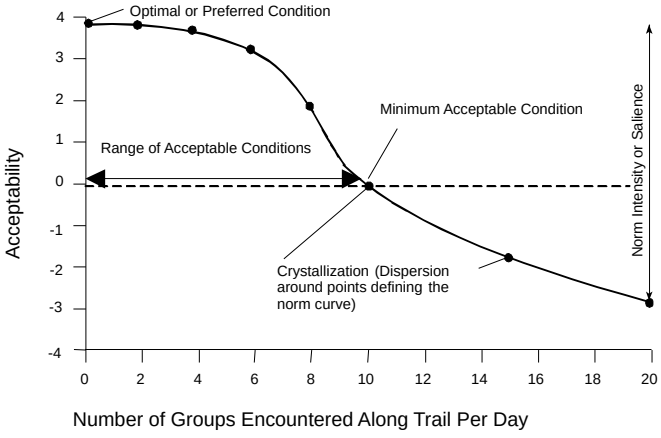

Figure 2—Norm curve.

Indicators of Quality

Indicators of quality are receiving increasing attention in the outdoor recreation literature. Normative theory and methods as described above have been applied less directly to indicators of quality than standards of quality. However, the extent to which visitors agree about the importance of potential indicators of quality is important and reflects a substantive normative component. Moreover, norm intensity or salience, as described above, is a measure of the importance of potential indicators of quality and can be derived from normative methods. The literature has addressed two important issues regarding indicators of quality: 1. criteria defining good indicators of quality and 2. studies designed to identify potential indicators of quality.

Characteristics for Good Indicators of Quality—Several studies have explored criteria that might be used to define effective indicators of quality in wilderness and related areas (Merigliano 1990; National Park Service 1997; Schomaker 1984; Stankey and others 1985; Whittaker and Shelby 1992). These criteria can be used to further understand the role of indicators and standards of quality in outdoor recreation and to help evaluate and select among potential indicator variables. Criteria for good indicators of quality include the following:

1. Specific. Indicators should define specific rather than general conditions. For example, "solitude" would not be a good indicator of quality because it is too general. "The number of other groups encountered per day along trails" would be a better indicator variable.
2. Objective. Indicators should be objective rather than subjective. That is, indicator variables should be measured in absolute, unequivocal terms. Variables that are subjective, expressed in relative terms or subject to interpretation make poor indicators. For example, "the number of people at one time at Wild Arch" is an objective indicator because it is an absolute number that can be readily counted and reported. However, "the percentage of visitors who feel crowded at Wild Arch" is a subjective indicator because it is subject to interpretation by visitors—it depends on the types of visitors making the judgment, the behavior of other visitors and other variables.
3. Reliable and repeatable. An indicator is reliable and repeatable when measurement yields similar results under similar conditions. This criterion is important because monitoring of indicator variables is often conducted by more than one person.
4. Related to visitor use. Indicators should be related to at least one of the following attributes of visitor use: level of use, type of use, location of use or behavior of visitors. A major role of indicators of quality is to help determine when management action is needed to control the impacts of visitor use. Thus, there should be a strong correlation between visitor use and indicators of quality.
5. Sensitive. Indicators should be sensitive to visitor use over a relatively short period of time. As the level of use changes, an indicator should respond in roughly the same proportional degree. If an indicator changes only after impacts are substantial, it will not serve as an early warning mechanism, allowing managers to react in a timely manner.
6. Manageable. Indicators should be responsive to and help determine the effectiveness of, management actions. The underlying rationale of indicators is they should be maintained within prescribed standards of quality. This implies that they must be manageable.
7. Efficient and effective to measure. Indicators should be relatively easy and cost-effective to measure. Indicators of quality should be monitored on a regular basis. Therefore, the more expertise, time, equipment and staff needed to take such measurements, the less desirable a potential indicator of quality may be.
8. Significant. Perhaps the most important characteristic of indicators is that they help define the quality of the visitor experience. This is inherent in the very term "indicator." It does little good to monitor the condition of a variable that is unimportant in defining the quality of the visitor experience.

It may be useful to incorporate these criteria within a matrix for evaluating potential indicators of quality, as shown in figure 3. Potential indicator variables can be arrayed along the horizontal axis of the matrix and rated as to how well they meet the criteria described above.

Potential Indicators of Quality—Research has also focused on identifying potential indicators of quality for a variety of recreation settings and activities, including wilderness areas. This research has been aimed at determining variables important to visitors in defining the quality of the recreation experience. In a broad sense, much of the research literature on outdoor recreation has some application to this issue. For example, preferences of visitors for site attributes, crowding and encounters with other visitors, motivations for recreation and conflict with other types of users all suggest potential indicators of quality. However, beyond these broad categories of research, several studies have addressed indicators of quality more directly. Potential indicators of quality identified in these studies are compiled in table 2.

These studies have addressed a variety of recreation areas and activities and utilized several study methods, including open- and closed-ended questions and surveys of visitors, interest groups, managers and scientists. However, at least five general conclusions might be derived from these study findings. First, it is apparent that potential indicators of quality can be wide ranging. It may be useful to employ a three-fold framework of outdoor recreation—environmental, social and managerial factors—when thinking about potential indicators of quality. All of the indicator variables in table 2 can be classified into environmental, social or managerial components.

Second, study findings suggest that many potential indicators of quality are rated at least somewhat important in defining the quality of the recreation experience. This is generally consistent with the "multiple satisfaction" or behavioral approach to outdoor recreation (Haas and others 1980; Hendee 1974; Driver and Toucher 1970).

Potential Indicators of Quality	Criteria for Good Indicators of Quality							
	Specific	Objective	Reliable & Repeatable	Related to Visitor Use	Sensitive	Manageable	Efficient & Effective to Measure	Significant
Indicator 1								
Indicator 2								
Indicator 3								
Indicator 4								
Indicator 5								
Indicator . . .								

Figure 3—Evaluation matrix for selecting indicators of quality.

Table 2—Potential indicators of quality.

Study/area/respondents	Potential indicator of quality
Mergliano 1990	- Number of campsites above an acceptable impact index
Wilderness	- Percent of visitors who report seeing wildlife
Wilderness managers	- Range condition and trend
and scientists	- Air visibility—extinction coefficient or visual range
	- Litter quantity—number of pieces of litter per campsite or per trail mile; number of pounds of garbage packed out each season
	- Number of manager-created structures
	- Number of signs per trail mile
	- Trail condition—length of multiple trails or number of trail miles with unacceptable problems to visitors (e.g., depth exceeding 8 inches, year-round muddiness)
	- Length of trail in areas managed as trailless
	- Fecal coliform/fecal streptococci ratio (drinking water quality)
	- Number of occupied campsites within sight or sound of each other or visitor report of number of groups camped within sight or sound
	- Number of violations of no-trace regulations
	- Percent of groups carrying a stove (not using a campfire)
	- Number of occurrences of unburied human feces
	- Number of occurrences of motorized noise per day
	- Percent of season wilderness rangers are out patrolling the area
	- Number of regulations that limit visitor use or restrict travel
	- Number of regulatory signs posted beyond trailhead
Shindler and Shelby 1992	- Amount of bare ground
Wilderness campsites	- Size and appearance of fire rings
Members of five interest	- Distance from trail
groups	- Screening from other sites
	- Out of sight/sound of other sites
	- Evidence of litter
	- View of scenery
	- Available firewood
	- Sheltered from weather
	- Dry and well drained
	- Water for aesthetic reasons
	- Flat place for sleeping- Close to good fishing
	- Logs and Rocks for seating
	- Close to drinking/cooking water
Whittaker 1992	- Litter
Five Alaska rivers	- Signs of use
Floaters, motorboats	- Campsite competition
	- Fishing competition
	- Launch congestion
	- River encounters
	- Camp encounters
	- Powerboat use
	- Airboat use
	- Rafting/canoeing use
	- Airplane landings
	- Helicopter landings
	- ORV use
	- Hazard signs
	- Interpretive signs
	- Public use cabins
	- Private cabins
	- Concessions
	- Long-term camps
Roggenbuck and others 1993	- Amount of litter I see
Four wilderness areas	- Number of trees around campsite that have been damaged by people
Visitors	- Amount of noise associated with human activities within the wilderness
	- Amount of man-made noise originating from outside the wilderness
	- Number of wild animals I see
	- Amount of vegetation loss and bare ground around a campsite

(con.)

Table 2—Con.

Study/area/respondents	Potential indicator of quality
	- Number of horse groups that camp within sight or sound of my campsite - Number of hiker groups that camp within sight or sound of my campsite - Number of horse groups that travel past my campsite while I am there - Number of campfire rings that people have made - Number of hiker groups that walk past my campsite - Number of large groups that I see along the trails - Number of horse groups I see along the trails in a day - Percent of time other people are in sight when I'm on the trail - Visibility of lights originating from outside the wilderness - Total number of people I see hiking along the trail - Number of groups of hikers I see along the trail - Amount of time I spend traveling on old roads in the wilderness - Number of miles of gravel road I travel to get to the wilderness
Shafer and Hammitt 1994 Cohutta Wilderness, GA Visitors	- The total amount of time that your party has in an area without seeing or hearing anyone else - The amount of restriction management places on where you may travel in the area - The number of permanent structures placed by management in the wilderness - Seeing an unusual type of plant - The amount of restriction management places on where you may camp in an area - The level of difficulty required to obtain an overnight permit - The number of vehicles you see at the trailhead - The number of fire rings found in a campsite - The number of days in a row you are able to stay in the wilderness on a given trip - The number of signs designating locations in the wilderness - The number of groups you pass during the day while traveling - Having signs placed by wilderness managers which state regulations about wilderness - The amount of wilderness which does not have trails in it - The distance of campfires from trailheads - The number of rangers you see in the area - The amount of ranger contact in the backcountry to check your permit and/or explain regulations about use - The amount of litter found in campsites - The amount of litter seen along the trail - The number of trees or other vegetation damaged by previous users - The amount of noise heard in the area which comes from outside the wilderness - The amount of fully mature forest in the wilderness area - Observing a natural ecosystem at work - The amount of solitude your group experiences - The amount of noise heard in the area which comes from other wilderness visitors - The number of different species of wildlife you see - The number of areas in the wilderness that are very remote - The distance between your campsite and the campsite of others - Seeing specific types of wildlife - The amount of light visible at night which comes from outside the wilderness - The level of trail maintenance - The number of groups that pass within sight of your camp - An area in the wilderness which is left completely primitive (no trails, bridges) - Having a portion of the wilderness where camping location is unconfined - Having trail markers placed by management (blazes, cairns, posts)
Manning and others 1995b; 1995c; 1996b; Manning and Lime 1996 Arches National Park, UT Visitors	- Orientation, information, and interpretive services - Number and type of visitor facilities - Number of people encountered - Visitor behavior and activities - Resource impacts - Park management activities - Quality and condition of natural features
Jacobi and others 1996 Acadia National Park, ME Carriage road visitors	- Number of visitors encountered - Type of visitors encountered (hikers or bikers) - Behavior of visitors (speed of bikers, keeping to the right, obstructing the roads, traveling off the roads)

Third, most of the studies on indicators of quality have found some variables more important than others. For example, litter and other signs of use impacts appear to be universally important. Management-related impacts (such as signs, presence of rangers) appear to be less important. Encounters with other visitors are important, but how these encounters are manifested may be even more important. For example, type of visitor encountered (for example, hikers encountering bikers or stock users, floaters encountering motorboaters) often is very important to the quality of the recreation experience. This is consistent with the recreation literature on crowding and conflict. Behavior of other visitors and associated noise are also important, as are "competition-related" impacts, such as having to share a campsite.

Fourth, visitors to wilderness or wilderness-related areas may be generally more sensitive to a variety of potential indicators of quality than visitors to more highly used and developed areas. However, research may have simply not yet identified and studied the indicators of quality that are most important to visitors in more highly used areas.

Fifth, for wilderness campsites, social indicators of quality may be generally more important than ecological indicators. For example, scenic views and screening from other campsites may be more important than amount of bare ground and size of fire rings. This is generally consistent with other research that suggests the importance of camping out of sight and sound of other groups and a general lack of perceptiveness on the part of many visitors abut the ecological impacts of recreation.

Standards of Quality

Standards of quality have received substantial attention in the outdoor recreation literature. As with the literature on indicators of quality, two important issues have been addressed: (1) characteristics of good standards of quality, and (2) studies designed to identify standards of quality.

Characteristics of Good Standards of Quality—Several studies have explored characteristics that might define good standards of quality (Brunson and others 1992; National Park Service 1997; Schomaker 1984; Whittaker and Shelby 1992). To the extent possible, good standards of quality should incorporate the following characteristics:

1. Quantitative. Standards should be expressed in a quantitative manner. Since indicators of quality are specific and measurable variables, standards of quality can and should be expressed in an unequivocal way. For example, if an indicator is "the number of encounters with other groups per day on the river," the standard might be "an average of no more than three encounters with other groups per day on the river." In contrast, "low numbers of encounters with other groups per day on the river" would be a poor standard of quality because it does not specify the minimum acceptable condition in unambiguous terms.
2. Time- or space-bounded. Incorporating a time- or space-bounded element into a standard of quality expresses both how much of an impact is acceptable and how often or where such impacts can occur. It is often desirable for standards to have a time period associated with them. This is especially relevant for crowding-related issues. For instance, in the above example, the standard of quality for encounters with other groups on the river was expressed in terms of "per day." Other time-bounded qualifiers might include "per night," "per trip," "per hour" or "at one time," depending on the circumstances.
3. Expressed as a probability. In many cases, it will be advantageous to include in the standard of quality a tolerance for some percentage of the time that a particular condition will be unavoidably unacceptable; in other words, the standard would include a probability that conditions will be at standard or better. For example, a standard might specify, "no more than three encounters with other groups per day along trails for 80% of days in the summer use season." The 80% probability of conditions being at or above standard allows for random or unusual events that might prevent management from attaining these conditions 20% of the time. This incorporates the complexity and randomness inherent in visitor use patterns. In the example of encounters along a trail, several hiking parties might depart from a trailhead at closely spaced intervals on a given day. These groups are likely to encounter each other on the trail several times during the day. On another day, the same number of groups might depart from the trailhead at widely spaced intervals and thereby rarely encounter each other. Similarly, it might be wise to incorporate a tolerance in standards for peak use days, holiday weekends or other days of exceptionally high visitation. A standard might be set at "50 people at one time at Wild Arch for 90% of the days of the year." The amount of tolerance needed depends on the unpredictability of each individual situation and the degree to which management can consistently control conditions.
4. Impact-oriented. Standards of quality should focus directly on the impacts that affect the quality of the visitor experience, not the management action used to keep impacts from violating the standards. For example, an appropriate standard might be, "no more than 10 encounters with other groups on the river per day." This could be a good standard because it focuses directly on the impact that affects the quality of the visitor experience—the number of other groups encountered. Alternatively, "a maximum of 20 groups per day floating the river" would not be as good a standard of quality because it does not focus as directly on the impact of concern—visitors experience encounters with other groups more directly than they experience total use levels. Basing standards of quality on management techniques rather than on impacts can also limit the potential range of useful management practices. For example, limiting the number of boats to 20 per day might be used to ensure 10 or fewer encounters per day, but other actions, such as more tightly scheduling launch times, could also ensure an appropriate encounter rate and could be less restrictive on the level of visitation to the river.
5. Realistic. Standards should generally reflect conditions that are realistically attainable. Standards that limit impacts to extremely low levels may set up unrealistic expectations in the minds of visitors, may be

politically infeasible and may unfairly restrict visitor use to very low levels.

Potential Standards of Quality—A growing number of studies have been conducted to help define standards of quality. Most of these have adopted the normative methods described earlier in this section. Findings from these studies are compiled in table 3. These studies have addressed a variety of recreation settings and potential indicators of quality. They have also used alternative question formats and wording, different response scales and other methodological variations. However, at least eight general conclusions can be derived from this growing body of literature.

First, normative standards can be measured for a variety of potential indicators of quality. While many studies have addressed encounter and other crowding-related variables, other studies have measured norms for widely ranging variables. Norms have been measured for a variety of ecological and social variables representing two of the three components of the basic three-fold framework of outdoor recreation.

Second, most respondents are able to report or specify norms for most variables included in most studies. This issue is sometimes referred to as "norm prevalence" (Kim and Shelby 1998). For example, 87% of canoeists in the Boundary Waters Canoe Area Wilderness reported a norm for the maximum acceptable number of other groups seen each day at the lake or river where they spent the most time (Lewis and others 1996a). There are some exceptions to this generalization. For example, a study of floaters on the New River in West Virginia, found that between 29% and 66% of respondents reported a norm for several indicator variables under three alternative types of recreation opportunities (Roggenbuck and others 1991). Other visitors chose one of two other response options, indicating that the potential indicator of quality did not matter to them, or that it did matter, but they couldn't specify a maximum amount of impact acceptable. Why visitors may not be able to report norms is discussed below.

Third, visitors tend to report norms more often in wilderness or backcountry situations than in frontcountry or more developed areas. Moreover, such wilderness-related norms tend to be more highly crystallized. For example, standard deviations of encounter norms for floaters on three Western rivers were found to increase as the recreation opportunity described moved from "wilderness" to "semi-wilderness" to "undeveloped recreation" (Shelby 1981). Moreover, the percentage of floaters on the New River who reported a series of encounter-related norms decreased across a similar spectrum of recreation opportunities (Roggenbuck and others 1991).

Fourth, norms tend to be lower (or less tolerant) in wilderness or backcountry areas than in frontcountry or more developed areas. This finding is reflected in many studies included in table 3.

Fifth, there is some consistency in norms within similar types of recreation areas or opportunities. For instance, a study of visitor norms for a variety of potential indicators of quality found broad agreement across all four wilderness areas addressed (Roggenbuck and others 1993). Moreover, a number of studies suggest that norms for encountering other groups during a wilderness experience are quite low (about three to five per day) and that most wilderness visitors prefer to camp out of sight and sound of other groups.

Sixth, norms generally fall into one of three categories or types: no-tolerance, single-tolerance and multiple-tolerance. For example, a study of boaters on the Deschutes River in Oregon, measured norms for a number of potential indicators of quality and found all three types of norms, as shown in figure 4 (Whittaker and Shelby 1988). The norm curve for human waste represents a no-tolerance norm: The majority of respondents report that it is never acceptable to see signs of human waste along the river. Other indicators of quality for which no-tolerance norms were reported included selected types of discourteous behavior and jetboat encounters for non-jetboaters. No-tolerance norms tend to be characterized by a mode at zero impact, high intensity and high crystallization.

The norm curve for time in sight of others represents a single-tolerance norm: The vast majority of respondents were willing to tolerate some time in sight of others, but they were unwilling to accept such impact beyond a certain level (two hours out of four in sight of others). Other indicators of quality for which single-tolerance norms were reported included jetboat encounters for jetboaters, launch waiting times, fishing disturbances, fishing competition, camp sharing and camp competition. Single-tolerance norms tend to be characterized by a mode at some level of impact greater than zero and a sharp decline in the percentage of respondents reporting tolerances for impacts greater than the modal value.

The norm curve for fire-ring impacts represents a multiple-tolerance norm: Multiple "peaks" along the norm curve indicate that there are at least two groups of respondents with distinctly different normative standards for this indicator of quality.

Seventh, encounter-related norms often vary with visitor characteristics, characteristics of those encountered, and situational variables. For example, a variety of norms have been found to be related to selected visitor characteristics, including organizational affiliation—activity groups versus environmental organizations— (Shelby and Shindler 1992), level of involvement with wilderness recreation (Young and others 1991), country of origin (Vaske and others 1995, 1996) and ethnicity (Heywood 1993a, Heywood and Engelke 1995). Research on effects of the characteristics of those encountered has focused primarily on type of activity. Encounter-related norms have been found to vary, depending on whether those encountered are fishers, canoers or tubers (Vaske and others 1986); boaters or bank fishers (Martinson and Shelby 1992); or hikers or bikers (Manning and others 1997). Finally, norms have been found to vary in relation to a number of situational or locational variables, including along the river versus campsites (Shelby 1981), type of recreation area (Shelby 1981, Vaske and others 1986), use level (Hall and Shelby 1996, Lewis and others 1996b, Shelby and others 1988b) and periphery versus interior locations (Martin and others 1989).

Eighth, the normative standards of visitors can vary from those of managers. For example, a study of norms for wilderness campsite impacts found that visitors reported more restrictive norms for the presence of fire rings and tree damage than managers did (Martin and others 1989). However, managers reported more restrictive norms for bare ground impacts.

Table 3—Normative standards of quality.

Study/area/respondents	Indicator of quality	Normative standard	
		Mean	Median
Stankey 1973	Encounters with paddling canoeists		3.5
Boundary Waters	Encounters with motor canoeists		0.0
Canoe Area, MN, Visitors	Encounters with motorboats		0.0
Three wilderness areas,	Encounters with backpacking parties		2.5
Visitors	Encounters with horse parties		1.8
Stankey 1980a,	Encounters with backpacking parties		4.0
Desolation Wilderness, CA,	Encounters with large parties		2.6
Visitors	Parties camped within sight or sound		2.4
Spanish Peaks Wilderness,	Encounters with backpacking parties		4.5
MT, Visitors	Encounters with horse parties		3.5
	Encounters with large parties		1.8
	Parties camped within sight or sound		1.9
Shelby 1981, Colorado River,	Encounters per day		.9/2.4/40[a]
Grand Canyon National Park,	Hours in sight of others each day		.5/.7/1.5
AZ, Boaters	Number of stops out of 10 with encounters		.7/2.0/3.8
	Chances of meeting 10-30 people at popular place on the river		9%/23%/41%
	Number of nights out of 10 camped near others		0/1.33.0
Rogue River, OR, Boaters	Encounters per day		1.5/2.9/4.4
	Hours in sight of others each day		.5/1.0/1.9
	Number of nights out of 5 camped near others		.6/1.6/2.3
			0/1.1/2.1
Illinois River, OR, Boaters	Encounters per day		.7/2.0/2.7
	Hours in sight of others each day		.4/.9/1.6
	Number of stops out of 5 with encounters		.2/1.3/1.8
	Number of nights out of 3 camped near others		0/.2/.7
Heberlein and others 1986	Number of boats moored at Anderson Bay		11.0
Apostle islands National	Number of boats moored at Quarry Bay		11.0
Lakeshore, WI, Boaters			
Vaske and others 1986	Encounters with fishers	7.2	
Brule River, WI, Floaters	Encounters with canoers	5.7	
	Encounters with tubers	2.3	
Shelby and others 1988a	Encounters per day on river	5.7	
Rogue River, OR, Boaters	Number of nights out of 5 camped near others	1.4	
Shelby and others 1988b	Maximum size of fire rings		
Mt. Jefferson Wilderness, OR,	-Hunts Lake	20 inches	
Campers	-Russell Lake	34 inches	
	Maximum area of bare ground		
	-Hunts lake	750 sq. ft	
	-Bays Lake	750 sq. ft	
	-Scout lake	1450 sq. ft	
Whittaker and Shelby 1988	Hours in sight out of four		1.8-2.2[b]
Deschutes River, OR, Boaters	Incidents of discourteous behavior per day		0.1-0.2
	Number of stops out of 4 where human waste is seen		0.1-0.3
	Jetboats encountered per day		0.3-1.3
	Boats per hour passing anglers		4.0-4.7
	Fishing holes passed up out of 4 due to competition		1.3-1.7
	Minutes waiting to launch		10.3-14.9
	Nights out of 4 camped with other groups		1.4-1.9
	Nights out of 4 camped near other groups		0.4-0.9
	Camps passed up out of 4 due to competition		1.1-1.2
	Camps out of 4 with fire rings present		0.5-1.1
Patterson and Hammitt 1990,	Encounters at trailhead	3.9	3.0
Great Smoky Mountains National	Encounters on trail	5.5	4.0
Park, NC/TN, Backpackers	Encounters at campsite	2.7	2.0
Roggenbuck and others 1991	Number of boats seen		
New River, WV, Floaters	-Wilderness whitewater	10.1	
	-Scenic whitewater	20.4	
	-Social recreation	33.4	
	Percent of time in sight of other boats		
	-Wilderness white water	18.3	
	-Scenic whitewater	32.3	
	-Social recreation	48.1	

(con.)

Table 3—Con.

Study/area/respondents	Indicator of quality	Normative standard	
		Mean	Median
	Number of rapids having to wait	1.2	
	-Wilderness whitewater	2.4	
	-Scenic whitewater	4.0	
	-Social recreation		
Young and others 1991,	Number of people hiking on trail in a day	11.5	
Chutta Wilderness, GA,	Number of large groups hiking on trail in a day		3.4
Visitors	Number of hiker groups camped in sight or sound of campsite		2.2
	Number of hiker groups walking past campsite in a day		3.7
	Number of horse groups seen on trail in a day	2.4	
	Number of horse groups camped in sight or sound of campsite		1.7
	Percent of time other people are in sight while on trail		13.9
	Number of groups of hikers seen on trail in a day		3.9
	Number of horse groups that travel past my campsite		1.2
Martinson and Shelby 1992	Encounters with bank fishers		
3 rivers, Salmon fishers	Preferred		
	-Klamath		—
	-Waimakariri		3.6
	-Lower Rakaia		3.5
	-Upper Rakaia		<1.0
	Tolerable		12.6
	-Klamath		6.9
	-Waimakariri		9.5
	-Lower Rakaia		3.8
	-Upper Rakaia		
Shelby and others 1992b	Minimum stream flow	10,000 cfs	
Colorado River, Grand Canyon	Maximum stream flow	45,000—50,000 cfs	
National Park, AZ,			
Guides and trip leaders			
Williams and others 1992,	Encounters with hiking groups along trail	8.7-11.6 [c]	
wilderness areas, Visitors	Encounters with horse groups along trail	5.1-6.	
	Encounters with large groups along trail	5.8-7.1	
	Hiker groups camped within sight or sound	3.8-6.9	
	Horse groups camped within sight or sound	3.1-3.8	
	Hiker groups passing by camp	5.5-7.9	
	Horse groups passing by camp	5.4-7.4	
Roggenbuck and others 1993,	Number of pieces of litter I can see from my campsite		0-2 [c]
4 wilderness areas, Visitors	Percent of trees around a campsite that have been damaged by people		0-5
	Number of horse groups that camp within sight or sound of my campsite		1-2
	Number of hiker groups that camp within sight or sound of my campsite		3
	Number of large groups (more than 6 people) that I see along the trail		3-5
	Percent of vegetation loss and bare ground around the campsite		10-20
Ewert and Hood 1995, Ewert 1998,	Encounters per day		
San Gorgonio Wilderness, CA;	-For urban-proximate wilderness	9.0	
John Muir Wilderness, CA, Visitors	-For urban-distant wilderness	7.7	
Hammitt and Rutlin 1995, Ellicott Rock	Encounters at trailhead		
Wilderness, SC/NC/GA, Visitors	-Ideal	3.8	
	-Maximum	8.7	
	Encounters on trail		
	-Ideal	3.2	
	-Maximum	6.6	
	Encounters at destination site		
	Ideal	1.0	
	-Maximum	2.5	
	Encounters at all three sites combined		
	-Ideal	2.7	
	-Maximum	5.9	

(con.)

Table 3—Con.

Study/area/respondents	Indicator of quality	Normative standard	
		Mean	Median
Shelby and Whittaker 1995,	Maximum stream flow		
Dolores River, CO, Boaters	-Large rafts	≈ 900 cfs	
	-Small rafts	≈ 750 cfs	
	-Canoes	≈ 300 cfs	
	-Kayaks	≈ 900 cfs	
Shindler and Shelby 1995,	Encounters with float parties		
Rogue River, OR, Boaters	-1977	5.7	
	-1991	7.4	
	Encounters with jetboats		
	-1977	1.5	
	-1991	1.5	
	Hours in sight of other parties		
	-1977	1.3	
	-1991	1.4	
	Acceptable number of stops out of five to meet another group		
	-1977	1.88	
	-1991	1.88	
	Acceptable number of nights out of five to camp within sight or sound of another party		
	-1977	1.4	
	-1991	1.2	
Watson 1995, Boundary Waters	Encounters with paddling groups	5.8-8.5[d]	
Canoe Area, MN, Canoers	Number of nearby campers	2.5-5.7	
Hall and Shelby 1996, Eagle Cap Wilderness, OR, Visitors	Encounters with other groups	5.6	4.0
Hall and others 1996, Clackamas	Encounters with other boaters	7.5/10.4[e]	6/8
River, OR, Floaters	Percent of time in sight of other boaters	49.4/46.4	50/50
	Number of minutes waiting at launch	16.1/18.1	15/15
Lewis and others 1996b,	Encounter with canoe parties on periphery lakes and rivers	5.1	3.1
Boundary Waters Canoe Area, MN,	Encounters with canoe parties on interior lakes and rivers	3.8	2.5
Canoeists	Encounters with canoe parties on all lakes and rivers	4.2	2.6
Manning and others 1995a, b,	PAOT at Delicate Arch	28	
Manning and Lime 1996,	PAOT at North Window	20	
Manning and others 1996b, c, Arches National park, UT, Visitors			
Vaske and others 1995, 1996, Columbia	PAOT at attraction site for snowcoach riders		
Ice Field, Jasper National Park,	-Canadian	96.2	
Canada, Snowcoach riders and hikers	-Anglo-American	100.5	
	-Japanese	114.6	
	-German	104.4	
	-British	84.5	
	PAOT at attraction site for hikers		
	-Canadian	47.3	
	-Anglo-American	55.6	
	-German	42.1	
	-British	41.3	
Manning and others 1997,	Persons per viewscape[f]		
Acadia National Park, ME,	Visual approach		
Carriage road users	Long form		
	-Hikers only	17	
	-Bikers only	12	
	-Even distribution of hikers and bikers	14	
	Short form		
	-Acceptability	11	
	-Tolerance	25	
	-Acceptability for “others”	15	
	-Management actions	18	
	Numerical approach		
	-Hikers only	16	
	-Bikers only	13	
	-Even distribution of hikers and bikers	18	

(con.)

Table 3—Con.

Study/area/respondents	Indicator of quality	Normative standard	
		Mean	Median
Tarrant and others 1997,	Maximum encounters tolerable		
Nantehala River, NC, Floaters	Rafters		
	With rafts		
	-On the river	28.4	
	-At put-in	12.3	
	-At rapids	9.3	
	With kayaks/canoes		
	-On the river	18.4	
	-At put-in	9.2	
	-At rapids	6.8	
	Kayakers/Canoers		
	With rafts		
	-On the river	37.4	
	-At put-in	14.1	
	-At rapids	10.3	
	With kayaks/canoes		
	-On the river	39.9	
	-At put-in	15.5	
	-At rapids	12.1	
Kim and Shelby 1998,	Quiet time in evening		
2 national park campgrounds in	Baemasagol Campground	10-11	10:00
Korea, Campers	Second Campground	11-12	12:00
	Incidences of inconsiderate behavior		
	Baemasagol Campground	0.69	0
	Second Campground	1.76	2
	Number of campers		
	Baemasagol Campground	71.6	60
	Second Campground	158.1	150
	Number of tents		
	Baemasagol Campground	28.9	23
	Second Campground	55.1	50
	Distance between tents (meters)		
	Baemasagol Campground	2.59	2
	Second Campground	2.15	1
	Number of sightings of litter		
	Baemasagol Campground	1.44	0
	Second Campground	2.15	1.5
	Waiting time for restroom (minutes)		
	Baemasagol Campground	2.54	1.75
	Second Campground	2.95	2
	Waiting time for water supply (minutes)		
	Baemasagol Campground	3.14	2.5
	Second Campground	3.67	3

[a]For wilderness, semi-wilderness, and undeveloped recreation.
[b]Range over three river segments.
[c]Range over four wilderness areas.
[d]Range over visitors using four entry points.
[e]Range over two question formats.
[f]Number of visitors per 100-meter trail segment.

Theoretical and Methodological Issues

The literature on normative standards in wilderness and outdoor recreation has given rise to a number of theoretical and methodological issues. First, attention has focused on the theoretical foundation of norms and their application to outdoor recreation (Heywood 1993a,b, 1996a,b; McDonald 1996; Noe 1992; Roggenbuck and others 1991; Shelby and Vaske 1991; Shelby and others 1996). As noted in the beginning of this section, the concept of norms originated in the fields of sociology and social psychology. In this context, norms traditionally address behaviors that are based on a sense of obligation and have social sanctions associated with them to help ensure broad compliance (Biddle 1986; Blake and Davis 1964; Cancian 1975; Homans 1950; Rossi and Berk 1985). However, as applied in the field of outdoor recreation, norms have been defined more broadly as "standards that individuals use for evaluating behavior, activities, environments, or management proposals as good or bad, better or worse" (Shelby and others 1996). In this context, recreation-related norms address conditions that are the result of behavior and measure the degree to which

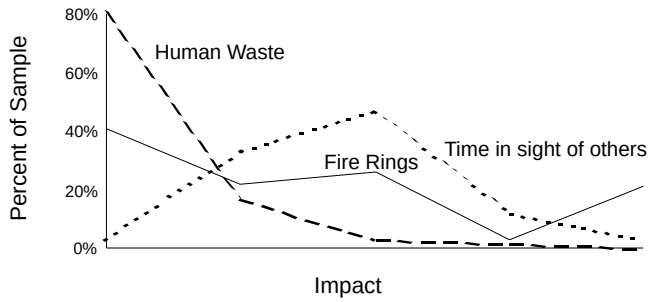

Figure 4—Three types of social norms (from Whittaker and Shelby 1988).

selected conditions "ought" to exist. While this may represent an expansion or extension of the traditional concept of norms, the studies in this section suggest that normative theory and methods can be useful in formulating indicators and standards of quality in wilderness and outdoor recreation. To avoid confusion and uncertainty in terminology, it may be wise to refer to the types of data described in this section as "personal evaluative standards" and "social evaluative standards," rather than personal and social norms. However, the term norms has become widely used in the wilderness and outdoor recreation literature.

Second, several studies have focused attention on the issue of norm salience. Early in this section, salience was defined as the importance of potential indicators of quality in determining the quality of the recreation experience. The issue of salience may help explain why some respondents do not report personal norms (Shelby and others 1996). When relatively large percentages of respondents do not report norms, it may be that the indicator of quality or impact under study is not important in determining the quality of the recreation experience. Several studies suggest the role of salience in recreation-related norms. As noted earlier, relatively low numbers of floaters on the New River reported norms for encounter-related indicators of quality when compared to other river recreation studies (Roggenbuck and others 1991). However, the New River is a relatively high-use area and encounter-related indicators of quality may be less important or salient in this context. This reasoning is supported by other studies, described earlier, which found that higher percentages of respondents reported norms for wilderness or backcountry areas than for frontcountry areas. Many of the indicators of quality addressed in these studies are encounter-related and may simply be less important or salient in frontcountry than in wilderness.

A closely related issue concerns how indicators of quality or impacts are perceived and manifested by recreation visitors. Measurement of recreation-related norms should focus as directly as possible on impacts that are relevant to visitors. In this way, visitors are more likely to be able to report norms, norms are likely to be more highly crystallized, and management will be focused more directly on issues of concern to visitors. Data from several studies support the importance of this issue. For example, in the New River study, a higher percentage of respondents reported a norm for waiting time to run rapids (while other boats took their turn) than for number of other boats seen (Roggenbuck and others 1991). Similarly, visitors to the Clackamas River in Oregon, another relatively high-use area, reported norms more often for percentage of time in sight of other boats than for number of other boats seen (Hall and others 1996). In relatively high-use areas, use levels may be perceived or manifested differently than in relatively low-use areas. Moreover, it may simply not be feasible to estimate or evaluate large numbers of encounters with other groups in high-use areas. Several studies have explored alternative expressions of use-related indicators of quality, including physical proximity of fishers along streams (Martinson and Shelby 1992), the number of people at one time (PAOT) at destination or attraction sites (Manning and others 1995a,b,c; Manning and Lime 1996, Manning and others 1996b,c; Manning and others 1997; Vaske and others 1996), persons per viewscape along trails (Manning and others 1997) and waiting times for essential services (Kim and Shelby 1998).

Third, visual approaches to measuring standards of quality have been explored in a number of studies (Heywood 1993a; Hof and others 1994; Manning and others 1995a,b,c; Manning and Lime 1996; Manning and others 1996b,c; Manning 1997, Manning and others 1998; Martin and others 1989; Shelby and Harris 1985; Shelby and others 1992a). These have included artistic renderings and photographs. For example, a series of 16 computer-enhanced photographs showing a range of visitors at an attraction site was used in a study of crowding-related norms at Arches National Park, Utah (Manning and others 1996c). Respondents rated the acceptability of each photograph and a norm for the maximum PAOT was determined. In certain situations, visual approaches may portray alternative levels of impact more realistically than written descriptions. The study at Arches also included a more traditional written measure of norms for the maximum acceptable PAOT. This norm was substantially lower than the one derived from the visual approach. It may be that the written approach to norm measurement draws conscious attention to each person or group encountered, whereas in the visual approach, some persons or groups who are perceived as similar to the respondent in terms of activity, behavior and appearance are processed less consciously and do not contribute as heavily to perceived crowding. The potential importance of perceptions of "alikeness" in crowding has been emphasized in the recreation literature (Adelman and others 1982; Cheek and Burch 1976; Lee 1972). In this respect, visual approaches may result in more realistic or "valid" measures of crowding-related norms in certain situations than written or narrative approaches.

Fourth, studies of recreation norms have used a variety of evaluative dimensions. When respondents are asked to evaluate impacts of a range of conditions for potential indicators of quality, the response scale may include terminology specifying "preference," "favorableness," "pleasantness," "acceptability," "tolerance" or some other concept. These alternative evaluative dimensions may have substantially different meanings to respondents and may result in dramatically different norms. Study findings support this assumption. Several studies have included measures of both preferred (or "ideal") conditions and acceptable (or "maximum" or "tolerable") conditions (Hammitt and Rutlin 1995; Watson 1995; Young and others 1991). In all cases, preferred

conditions for encounter-related variables are substantially lower—less than half—than acceptable conditions. The literature on norm theory has suggested that norm measurement questions adopt more explicitly normative concepts and terminology (Heywood 1996a). This might include the condition that managers "should" maintain and respondents' beliefs about what "other visitors" feel is acceptable. An initial test of these concepts found that they yielded significantly higher encounter-related norms than acceptability to respondents (Manning and others 1997, 1999). None of these evaluative dimensions may be more "valid" than any others, but researchers and managers should be conscious of this issue and exercise appropriate care and caution in interpreting and applying study findings. For example, standards of quality based on preference-related norms may result in very high-quality recreation experiences, but may restrict access to a relatively low number of visitors. In contrast, standards of quality based on acceptability or tolerance may result in recreation experiences of only marginal quality, but allow access to a larger number of visitors. Studies that employ multiple evaluative dimensions may result in findings that enrich the information base on which standards of quality might be formulated.

Fifth, studies of recreation norms have also used alternative question-and-response formats. Early in this section, it was noted that norms are sometimes measured using a repetitive-item (or "long") format, in which respondents are asked to evaluate a range of alternative conditions. An open-ended (or "short") version of this question format has also been employed, in which respondents are asked to specify the maximum acceptable level of impact. Only one study has used both question formats, and this found that the short-question format yielded a lower encounter-related norm (Manning and others 1997, 1999). Several studies have explored the range of response options that might be included in norm measurement questions (Hall and Shelby 1996; Hall and others 1996; Roggenbuck and others 1991). In particular, these studies addressed the issue of whether respondents should be presented with an option which indicates that the indicator of quality is important to them, but that they cannot specify a maximum number that is acceptable. The principal argument in favor of this option suggests that respondents should not be "forced" into reporting a norm in which they have little confidence. The principal argument against this option is that it may simply present some respondents with a convenient way to avoid a potentially difficult question. The only empirical tests directed at this issue found that respondents who chose this option were more like respondents who reported a norm (with respect to reactions to impacts and attitudes toward management) than those who reported that the indicator of quality was not important to them (Hall and Shelby 1996). Moreover, use of this response option did not affect the value of the norm derived, although it did affect the variance or crystallization of the norm (Hall and others 1996). Thus, use of this response option may not be an important consideration.

Sixth, crystallization of norms is an important research and management issue. As noted earlier in this section, crystallization refers to the level of agreement or consensus about recreation norms. The more agreement about norms, the more confidence managers might have in using such data to formulate standards of quality. Most norm-related studies have reported some measure of crystallization. Standard deviations of mean and median values of norms are used most frequently, but coefficients of variation and semi-interquartile ranges have also been recommended to allow comparisons across variables and reduce the effects of extreme values (Hall and Shelby 1996; Roggenbuck and others 1991). However, there are no statistical guidelines or rules of thumb to indicate what constitutes high or low levels of agreement or consensus, and there is disagreement in the literature concerning how recreation-related norms should be interpreted. Ultimately, some degree of judgment must be rendered by managers. If there appears to be moderate to high levels of agreement over norms, managers can incorporate study findings into their decisions with relative confidence. If there does not appear to be much agreement over norms, managers might focus on resolving conflicts among visitors, consider zoning areas for alternative recreation experiences or formulate norms based on other considerations.

Seventh, as research on norms has matured, attention has focused on the issue of norm congruence, sometimes called "norm-impact compatibility" (Shelby and Vaske 1991). This issue concerns the extent to which respondents evaluate relevant aspects of the recreation experience in keeping with their normative standards. If recreation norms are to be used in formulating standards of quality, research on norm congruence is important to test the internal consistency or "validity" of such norms. A number of studies have addressed this issue across a variety of activities, indicator variables and areas (Hammitt and Patterson 1991; Hammitt and Rutlin 1995; Lewis and others 1996b; Manning and others 1996c,d; Patterson and Hammitt 1990; Ruddell and Gramann 1994; Vaske and others 1986, 1996; Williams and others 1991). Nearly all have found support for the concept of norm congruence; that is, when conditions violate visitor norms, respondents tend to judge such conditions as less acceptable or more crowded and adopt behaviors to avoid them. Only one study has not supported norm congruence (Patterson and Hammitt 1990). However, this study was conducted in a relatively high-use area, where encounter norms may not have been salient or highly crystallized.

Eighth, a variety of statistics are available for measuring, analyzing and interpreting norms (Shelby and Heberlein 1986; Shelby and others 1996; Vaske and others 1986; Whittaker and Shelby 1988). Each has advantages and disadvantages, and these should be considered when selecting appropriate statistical approaches. Norms are generally reported and described in terms of medians and means. Median values have intuitive appeal because they represent the level of impact that half of respondents find acceptable. Mean values are more intuitively straightforward and are easier to calculate, but they are easily skewed by outlying or extreme values and may be misleading in the case of multiple-tolerance norms. Norm curves like those illustrated in figures 2 and 4, as well as frequency distributions which show the level of agreement associated with each impact level, are less parsimonious, but they offer considerably more information in a graphic and less technical way. Statistical measures of norm crystallization were discussed earlier in this section.

Ninth, research methods used to measure norms have varied widely across the studies reviewed in this section. This applies especially to question format and wording.

Experimentation in research approaches is clearly warranted to identify and address emerging issues and to test the effectiveness of alternative methodological approaches. However, when possible, replication and standardization of research approaches are desirable to enable comparisons across studies and over time. A compendium of frequently used norm-related questions is contained in Donnelly and others (1992) and may be useful in moving toward more consistent research approaches, when advisable.

Tenth, the stability of recreation norms over time has received little research attention, but may become increasingly important. Do norms change or evolve over time? If so, should such changes be incorporated into how wilderness and related areas are managed? The answer to the first question is a technical issue, while the second is more philosophical. Few studies have addressed the variability of norms over time. Those that have have generated mixed or inconclusive results. For example, a 1977 study of encounter norms for boaters on the Rogue River in Oregon, was replicated in 1984 (Shelby and others 1988a). No statistically significant difference was found for the number of acceptable river encounters. However, camp encounter norms were found to be significantly higher or more tolerant in the latter study. A similar study conducted in three wilderness areas over a longer interval found few clear, consistent trends in tolerance for inter-group contacts (Cole and others 1995). Two other studies have found substantial stability of norms over time; however, these studies cover only a two-to-three-year time period (Kim and Shelby 1998; Manning and others 1999).

Arguments about whether changes in norms should be incorporated into management plans are divided. The underlying rationale of indicators and standards of quality is that they should be set and maintained for some extended period of time, usually defined as the life of the management plan for which they are formulated. Thus, during this time period, standards of quality probably should not be revised substantially. However, management plans are periodically reformulated to reflect the changing conditions of society. It seems reasonable to reassess recreation norms as part of this process and incorporate these findings within long-term planning processes.

Finally, two organizational frameworks have been suggested to help guide development of indicators and standards of quality and subsequent monitoring and management action. An "importance-performance" framework has been suggested as an aid to formulating indicators and standards of quality (Hollenhorst and others 1992; Hollenhorst and Stull-Gardner 1992; Hollenhorst and Gardner 1994; Mengak and others 1986). Visitors are first asked to rate the importance of potential indicator variables, and these results are plotted along a vertical axis, as shown in figure 5. Second, visitors are asked a series of normative questions regarding standards of quality for each indicator variable. These data are then related to existing conditions and plotted on a horizontal axis, as shown in figure 5. The resulting data provide a graphic representation of the relationship between importance and performance of indicator variables, and where management action should be directed. The data in figure 5, for example, are derived from a survey of visitors to the Cranberry Wilderness in West Virginia, and suggest that indicator variable "A" ("number of parties of people I see each day") is important to visitors, but that visitors currently see more parties of people per day than their standard of quality (Hollenhorst and Gardner 1994). These findings suggest that managers should concentrate their attention on this indicator of quality.

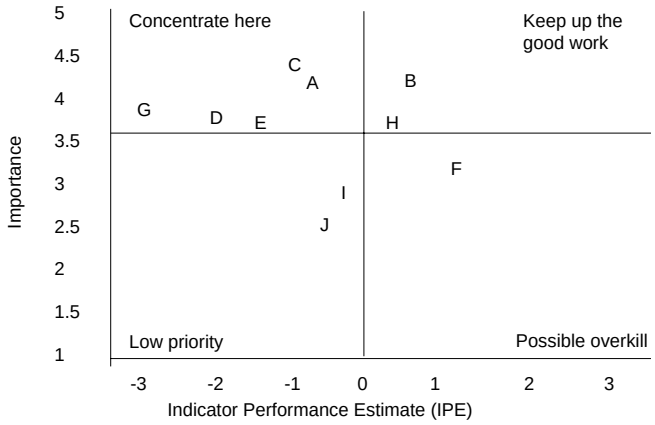

Figure 5—Importance-performance analysis (from Hollenhorst and Gardner 1994).

An outdoor recreation "threats matrix" is another framework that might be applied to indicators and standards of quality (Cole 1994; Leopold and others 1971; Manning and Moncrief 1979). A matrix model of outdoor recreation impacts can be created by arraying important attributes of outdoor recreation to form the rows of a matrix and arraying potential threats to those attributes as the columns of the matrix. Each cell within the resulting matrix represents the various impacts that each threat causes to each attribute. An example of such a matrix is shown in figure 6. This example was developed to determine the significance of threats to wilderness areas within the Northern Region of the U.S. Forest Service (Cole 1994). This example applies to wilderness very broadly, but can be developed more specifically for outdoor recreation. Such a matrix can be

	Wilderness Threats							
Attributes of wilderness character	**Recreation**	**Livestock**	**Mining**	**Fire**	**Exotic species**	**Water projects**	**Atmospheric pollutants**	**Adjacent lands**
Air	1	1	1	2	1	1	4	3
Aquatic systems	4	3	3	4	4	3	4	3
Rock/landforms	1	2	2	1	1	2	1	1
Soils	3	3	2	5	2	2	4	2
Vegetation	3	3	2	5	4	3	4	2
Animals	4	2	2	4	3	2	2	4
Ecosystems/landscapes	2	3	2	5	3	2	4	5
Cultural resources	3	2	2	2	1	1	1	1
Wilderness experiences	4	3	2	3	2	2	2	3

Figure 6—Wilderness threats matrix. Matrix values are significance ratings for the impacts of each potential threat on each wilderness attribute for all wilderness areas in the U.S. Forest Service's Northern Region. Ratings range from 1 (low) to 5 (high) (from Cole 1994).

useful for identifying potential indicators of quality (important attributes of outdoor recreation that are impacted by potential threats) and the extent to which such indicator variables are threatened and, therefore, need monitoring and management attention.

Managing Wilderness Recreation

The wilderness recreation management frameworks described at the beginning of this paper specify that management action must be taken to ensure that standards of quality are maintained. But what management actions are available to managers? Moreover, how effective are these alternative management practices? This section of the paper outlines a series of alternative management practices and reviews a growing number of studies designed to evaluate their effectiveness. Based on this review, a number of guidelines and related insights are developed on managing outdoor recreation in wilderness and related areas to protect the quality of the recreation experience.

Alternative Management Practices

Many writers have suggested a variety of management practices that might be applied to wilderness and related outdoor recreation. It is useful to organize these practices into classification systems to illustrate the broad spectrum of alternatives available to wilderness managers.

One classification system defines alternatives on the basis of management strategies (Manning 1979). Management strategies are basic conceptual approaches to management that relate to achievement of desirable objectives. Four basic strategies can be identified for managing outdoor recreation, as illustrated in figure 7. Two strategies deal with supply and demand: The supply of recreation opportunities may be increased to accommodate more use, or the demand for recreation may be limited through restrictions or other approaches. The other two basic strategies treat supply and demand as fixed and focus on modifying either the character of recreation, to reduce its adverse impacts, or the resource base, to increase its durability.

There are a number of sub-strategies within each of these basic management strategies. The supply of outdoor recreation areas, for example, can be increased in terms of both space and time. With respect to space, new areas may be added, or existing areas might be used more effectively through additional access or facilities. With respect to time, some recreation use might be shifted to off-peak periods.

Within the strategy of limiting demand, restrictions might be placed on the total number of visitors that are allowed or their length of stay. Alternatively, certain types of use that have demonstrably high social and/or environmental impacts might be restricted.

The third basic management strategy suggests reducing the social or environmental impacts of existing use. This might be accomplished by modifying the type or character of use or by dispersing or concentrating use according to user compatibility or resource capability.

A final basic management strategy involves increasing the durability of the resource. This might be accomplished by hardening the resource itself (through intensive maintenance, for example) or developing facilities to accommodate use more directly.

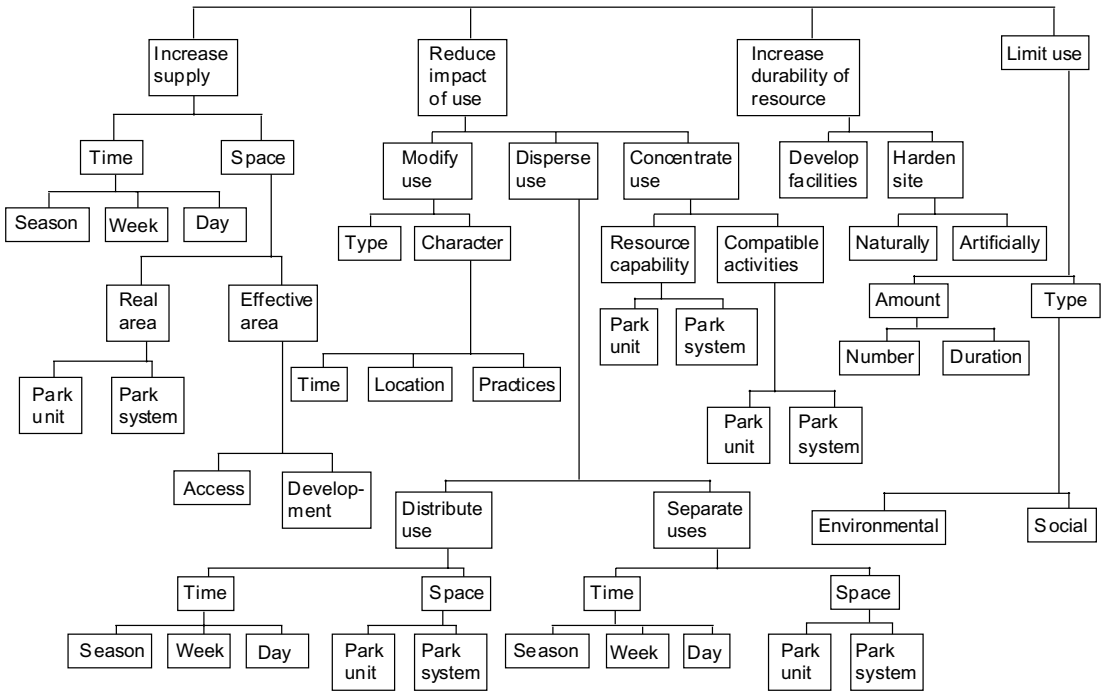

Figure 7—Strategies for managing outdoor recreation (from Manning 1979).

A second system of classifying management alternatives focuses on tactics or actual management practices. Management practices are direct actions or tools applied by managers to accomplish the management strategies described above. Restrictions on length of stay, differential fees and use permits, for example, are management practices designed to accomplish the strategy of limiting recreation demand. Management practices are often classified according to the directness with which they act on visitor behavior (Chavez 1996; Gilbert and others 1972; Lime 1977c, G. Peterson and Lime 1979). As the term suggests, direct management practices act directly on visitor behavior, leaving little or no freedom of choice. Indirect management practices attempt to influence the decision factors on which visitors base their behavior. A conceptual diagram illustrating direct and indirect recreation management practices is shown in figure 8. As an example, a direct management practice aimed at reducing campfires in a wilderness environment would include both a regulation barring campfires and enforcement of this regulation. An indirect management practice would be an education program designed to inform visitors of the undesirable ecological and aesthetic impacts of campfires and to encourage them to carry and use portable stoves instead. A series of direct and indirect management practices is shown in table 4.

The relative advantages and disadvantages of direct and indirect recreation management practices have received substantial attention in the recreation literature. Generally, indirect management practices are favored when and where they are believed to be effective (G. Peterson and Lime 1979, McCool and Christensen 1996). This is particularly true for wilderness and related types of outdoor recreation opportunities (Clark and Stankey 1979, Hendee and others 1990). Indirect management practices are favored for several reasons (McCool and Christensen 1996). First, legislation and management agency policies applied to wilderness and related areas often emphasize provision of recreation opportunities that are "unconfined." Thus, direct regulation of visitor behavior may be inconsistent with such management objectives. Second, recreation is a form of leisure activity connoting freedom of choice in thought and actions. Regulations designed to control visitor behavior can be seen as antithetical to the very nature of recreation. Especially in the context of wilderness and related areas, recreation and visitor regulation have been described as "inherently contradictory" (Lucas 1982). Third, many studies indicate that,

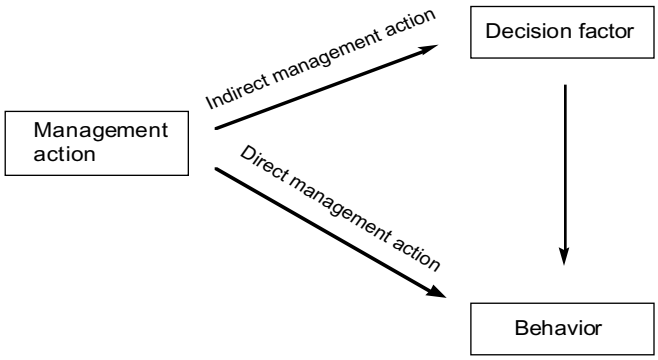

Figure 8—Diagram of direct versus indirect management tactics (adapted from G. Peterson and Lime 1979).

Table 4—Direct and indirect management practices (adapted from Lime 1977c and 1979).

Type	Example
Direct	
(Emphasis on regulation of behavior; individual choice restricted; high degree of control.)	Impose fines Increase surveillance of area Zone incompatible uses spatially (hiker only zones, prohibit motor use, etc.) Zone uses over time Limit camping in some campsites to one night, or some other limit Rotate use (open or close roads, access points, trails, campsites, etc.) Require reservations Assign campsites and/or travel routes to each camper group in backcountry Limit usage via access point Limit size of groups, number of horses, vehicles, etc. Limit camping to designated campsites only Limit length of stay in area (maximum/minimum) Restrict building of campfires Restrict fishing or hunting
Indirect	
(Emphasis on influencing or modifying behavior; individual retains freedom to choose; control less complete, ore variation in use possible.)	Improve (or not access roads, trails Improve (or not) campsites and other concentrated use areas Improve (or not) fish and wildlife populations (stock, allow to die out, etc.) Advertise specific attributes of the area Identify the range of recreation opportunities in surrounding area Educate users to basic concepts of ecology Advertise underused areas ad general patterns of use Charge consistent entrance fee Charge differential fees by trail, zone, season, etc. Require proof of ecological knowledge and recreational activity skills

given the choice, visitors prefer indirect over direct management practices (Lucas 1983). Finally, indirect management practices may be more efficient because they do not entail the costs associated with enforcement of rules and regulations.

Emphasis on indirect management practices, however, has not been uniformly endorsed (Cole 1993; McAvoy and Dustin 1983; Shindler and Shelby 1993). It has been argued that indirect practices may be ineffective. There will always be some visitors, for example, who will ignore management efforts to influence the decision factors that lead to behavior. The action of a few may, therefore, hamper attainment of management objectives. It has been argued, in fact, that a direct, regulatory approach to management can ultimately lead to more freedom rather than less (Dustin and McAvoy 1984). When all visitors are required to conform to mutually agreed-on behavior, management objectives are more likely to be attained and a diversity of recreation opportunities preserved. There is empirical evidence to suggest that, under certain circumstances, direct management practices can enhance the quality of the recreation experience (Frost and McCool 1988; Swearingen and Johnson 1995). Moreover, research suggests that visitors are surprisingly supportive of direct management practices when they are needed to control the impacts of recreation use (D. Anderson and Manfredo 1986, Shindler and Shelby 1993).

An analysis of management problems caused by visitors suggests that both direct and indirect management practices can be applicable depending upon the context (Alder 1996; Gramann and Vander Stoep 1987). There are several basic reasons why visitors may not conform to desired standards of behavior. These range from lack of knowledge about appropriate behavior to willful rule violations. Indirect management practices, such as information and education programs, seem most appropriate in the case of the former, while direct management practices, such as enforcement of rules and regulations, may be needed in the case of the latter.

It has been suggested that there is actually a continuum of management practices that range from indirect to direct (Hendricks and others 1993, McCool and Christensen 1996). As an example, an educational program on the ecological and aesthetic impacts of campfires would be found toward the indirect end of a continuum of management practices. A regulation requiring campers to use portable stoves instead of campfires would be a more direct management practice. Aggressive enforcement of this regulation with uniformed rangers would clearly be a very direct management practice. This suggests that management practices might also be viewed as ranging along two dimensions, as illustrated in figure 9. Not only can management practices be direct or indirect, they can also be implemented in an obtrusive or unobtrusive manner. It has also been suggested that direct and indirect management practices are not mutually exclusive and that, in fact, they can often complement each other (Alder 1996, Cole and others 1997a). For example, a regulation banning campfires (a direct management practice) should be implemented in conjunction with an educational program explaining the need for such a regulation (an indirect management practice).

Classification of management practices might be based on many factors or concepts. The approaches described above simply illustrate the array of alternatives available for wilderness recreation management. For any given problem, there are likely several potential solutions. Explicit consideration should be given to this variety of approaches rather than relying on those that are familiar or administratively expedient.

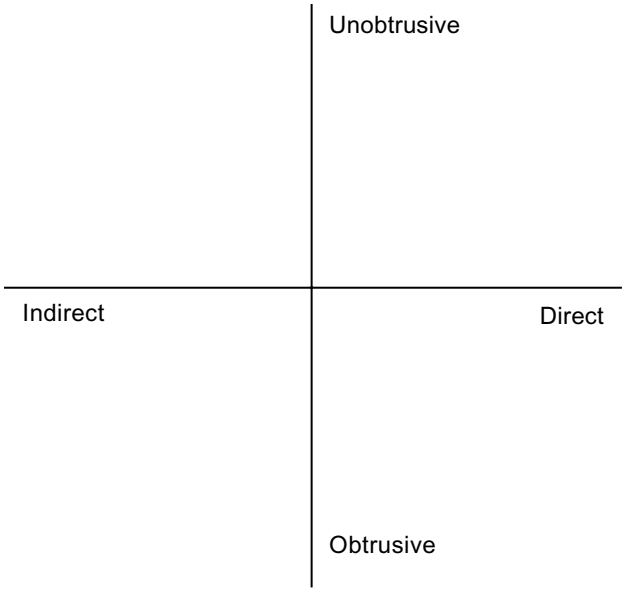

Figure 9—Two dimensions of recreation management practices (adapted from McCool and Christensen 1996).

Evaluating Management Practices

A growing body of literature has focused on the potential effectiveness of selected recreation management practices. This literature can be organized into several broad categories of management approaches, including (1) visitor information and education programs, (2) use rationing and allocation, and (3) other recreation management practices.

Information and Education—Substantial research and management attention have focused on information and education programs as a recreation management practice. This practice is generally seen as an indirect and "light-handed" management approach. As a recreation management practice, information and education programs are designed to persuade visitors to adopt behaviors that are compatible with recreation management objectives. Research suggests that recreation visitors tend to view this approach very favorably (McCool and Lime 1989; Roggenbuck and Ham 1986; Roggenbuck 1992, Stankey and Schreyer 1987; Vander Stoep and Roggenbuck 1996).

A conceptual application of information and education to recreation management problems is illustrated in table 5. This table classifies problem behaviors in wilderness and related outdoor recreation into five basic types and suggests the potential effectiveness of information and education on each. At the two ends of the spectrum, problem behaviors can be seen as either deliberately illegal (for example, theft of Indian artifacts) or unavoidable (for example, disposal of human waste). In these instances, information and educa-

Table 5—Application of information and education to recreation management problems (adapted from Hendee and others 1990, Roggenbuck 1992 and Vander Stoep and Roggenbuck 1996).

Type of problem	Example	Potential effectiveness of information and education
Illegal	Theft of Indian artifacts. Invasion of wilderness by motorized off-road vehicles	Low
Careless actions	Littering. Nuisance activity (e.g., shouting)	Moderate
Unskilled actions	Selecting improper camping spot. Building improper campfire	High
Uninformed actions	Selecting a lightly used campsite in the wilderness. Using dead snags for firewood. Camping in sight or sound of another party	Very high
Unavoidable actions	Human body waste. Loss of ground cover vegetation in the campsite	Low

tion may have little or no effectiveness. However, the other three types of problem behaviors—careless actions (such as littering), unskilled actions (such as selecting an improper campsite) and uninformed actions (such as using dead snags for firewood)—may be considerably more amenable to information and education programs.

A second conceptual approach to the application of information and education is based on theories of moral development and is illustrated in table 6. This approach builds on two prominent theories of moral development suggested by Kohlberg (1976) and Gilligan (1982). Both theories suggest that people tend to evolve through a series of stages of moral development, ranging from those that are very self-centered to those that are highly altruistic and are based on principles of justice, fairness and self-respect. Individual visitors to wilderness areas may be found at any of the stages of moral development shown in table 6. The management implications of this conceptual approach suggest that information and education programs should be designed to reach visitors at each of these stages of moral development. For example, to reach visitors at lower levels of moral development, managers might emphasize extrinsic rewards and punishments for selected types of behavior. However, communicating with visitors at higher levels of moral development might be more effective by means of emphasizing the rationale for selected behaviors and a sense of altruism, justice and fairness.

Application of communication theory to outdoor recreation suggests that the potential effectiveness of information and education depends on a number of variables associated with visitors and the content and delivery of messages (Basman and others 1996; Bright and others 1993; Bright and Manfredo 1995; Manfredo 1989; Manfredo and Bright 1991; Manfredo 1992; Roggenbuck and Ham 1986; Roggenbuck 1992; Stankey and Schreyer; 1987; Vaske and others 1990). For example, visitor behavior is at least partially driven by attitudes, beliefs and normative standards. Information and education programs aimed at "connecting" with or modifying relevant attitudes, beliefs or norms may successfully guide or change visitor behavior. Moreover, the substance of messages and the media that deliver them may also influence the effectiveness of information and education programs.

Table 6—Stages of moral development (from H. Christenson and Dustin 1989).

Kohlberg's six stages of moral development		Gilligan's perspectives on moral development	
Stage	**Overriding concern**	**Perspective**	**Overriding Concern**
Preconventional morality			
1	Fear of punishment	1	Reference and relation to self; survival; self-oriented; similar to Kohlberg's 1 and 2
2	Minimizing pain/ Maximizing pleasure		
Conventional morality			
3	What significant others think	2	Reference and relation to others; pleasing others is important; somewhat similar to Kohlberg's 3 and 4
4	What society thinks		
Postconventional morality			
5	Justice and fairness	3	Reference and relation to self and others; integration of 1 and 2 above; caring is the highest value; departs from Kohlberg at this point
6	Self-respect		

From a theoretical standpoint, information and education can be seen to operate through three basic models (Roggenbuck 1992). The first is applied behavior analysis. This approach to management focuses directly on visitor behavior rather than antecedent variables such as attitudes, beliefs and norms. For example, visitors can be informed of rewards or punishments that depend on visitor behavior. Applied behavior analysis is the simplest and most direct theoretical model of information and education. However, since it does not address underlying behavioral variables such as attitudes, beliefs and norms, its effectiveness may be short term and dependent upon continued management action.

A second theoretical model of information and education is the central route to persuasion. In this model, visitors' relevant beliefs are modified through delivery of substantive messages. New or modified beliefs then lead to desired changes in behavior. While this is a less direct and more complex model, it may result in more lasting behavioral modification.

A third theoretical model of information and education is the peripheral route to persuasion. This model emphasizes nonsubstantive elements of information and education messages, such as message source and medium. For example, messages from sources considered authoritative or powerful by visitors may influence behavior, while other messages may be ignored. This model may be especially useful in situations where it is difficult to attract and maintain the attention of visitors, such as at visitor centers, entrance stations and bulletin boards, all of which may offer multiple and competing information and education messages. However, like applied behavior analysis, the peripheral route to persuasion may not influence antecedent conditions of behavior and, therefore, may not have lasting effects.

A relatively large number of empirical studies have examined the effectiveness of a variety of information and education programs. These studies fall into several categories, including (1) those designed to influence recreation use patterns, (2) studies focused on enhancing visitor knowledge, especially knowledge related to minimizing ecological and social impacts, (3) studies aimed at influencing visitor attitudes toward management policies, and (4) studies that address depreciative behavior such as littering and vandalism.

Recreation Use Patterns—Recreation use patterns are often characterized by their uneven spatial and temporal nature (Cole 1996; Cole and others 1997a; Glass and others 1991; Glass and Walton 1995; Hendee and others 1976; Leonard and others 1978; Lime 1977b; Lucas 1980; Manning and Cormier 1980; Manning and others 1984; Manning and Powers 1984; M. Peterson 1981; Plumley and others 1978; Roggenbuck and Lucas 1987;Stankey and others 1976). Problems such as crowding may be reduced if use patterns can be redistributed to some degree. Using computer-based simulation models, a number of studies have documented the effectiveness of spatial and temporal use redistribution in reducing contacts among recreation groups (deBettencourt and others 1978; Gilbert and others 1972; McCool and others 1977; Manning and Ciali 1979; Manning and Potter 1982,1984; G. Peterson and others 1977; G. Peterson and deBettencourt 1979; G. Peterson and Lime 1980; Potter and Manning 1984; Romesburg 1974; Rowell 1986; Schecter and Lucas 1978; Smith and Krutilla 1974, Smith and Headly 1975, Smith and Krutilla 1976; Underhill and others 1986, Van Wagtendonk and Coho 1986; Wang and Manning 1999). It has been shown, for example, that a nearly 20% cut in total use would be required to achieve the same reduction in contacts obtainable through use redistributions (Potter and Manning 1984).

Several studies have explored the potential effectiveness of information and education programs as a means of redistributing recreation use. An early study examined the use of roadside signs to redistribute use and found them effective (P. Brown and Hunt 1969). Similarly, the use of positively and negatively oriented trail signs were found to redistribute use at Rocky Mountain National Park in Colorado (Ormrod and Trahan 1977). Even simple designation of a site as an "official" park or wilderness area can lead to increased use (Becker 1981). Another early study explored the effectiveness of providing visitors with information on current use patterns as a way to alter future use patterns (Lime and Lucas 1977). Visitors who had permits for the most heavily used entry points in the Boundary Waters Canoe Area were mailed an information packet that included a description of use patterns, noting in particular heavily used areas and times. A survey of a sample of this group who again visited the study area the following year found that three-fourths of respondents felt this information was useful, and about one-third were influenced in their choice of entry point, route, or time of subsequent visits.

A study in the Shining Rock Wilderness Area of North Carolina experimented with two types of information programs designed to disperse camping away from a heavily used meadow (Roggenbuck and Berrier 1981, 1982). Two treatment groups were created. A brochure explaining resource impacts associated with concentrated camping and showing the location of other nearby camping areas was given to one treatment group, while the other was given the brochure along with personal contact with a wilderness ranger. Both groups dispersed their camping activity to a greater degree than a control group, but there was no statistically significant difference between the two treatment groups.

A similar experiment was conducted on trail use in the backcountry of Yellowstone National Park (Krumpe and Brown 1982). Before obtaining a backcountry permit, a sample group of hikers was given a guidebook that described the attributes of lesser-used trails. A later survey and examination of permits found that 37% of this group had selected one of the lesser-used trails in the trip planning process compared to 14% of a control group. Results also indicated that the earlier the information was received, the more influence it had on behavior. Studies employing user-friendly microcomputer-based information approaches have also been found to be effective in influencing recreation use patterns (Alpert and Herrington 1998; D. Harmon 1992; Huffman and Williams 1986, 1987; Hultsman 1988).

Hikers in the Pemigewasset Wilderness of New Hampshire were studied to determine the influence of wilderness rangers as a source of information and education (C. Brown and others 1992). Only about 20% of visitors reported that the information received from wilderness rangers influenced their destination within the study area. However, visitors who were less experienced and who reported that

they were more likely to return to the study area were more likely to be influenced by the information provided, suggesting that the information program may be more effective over time.

Potential problems in using information and education programs to influence recreation use were illustrated in a study in the Selway-Bitterroot Wilderness of Montana (Lucas 1981). Brochures describing current recreation use patterns were distributed to visitors. Follow-up measurements indicated little effect on subsequent use patterns. Evaluation of this program suggested three limitations on its potential effectiveness: (1) many visitors did not receive the brochure, (2) most of those who did receive the brochure received it too late to affect their decision-making, and (3) some visitors doubted the accuracy of the information contained in the brochure.

Visitor Knowledge—A second category of studies has focused primarily on enhancing visitor knowledge through information and education programs. Most of these studies have examined knowledge associated with reducing the potential ecological and social impacts caused by recreation. Two early studies focused on distinct types of users—backpackers in Rocky Mountain National Park (Fazio 1979b) and motorists in a New York state park (Feldman 1978). The study of backpackers provided information on low-impact camping practices through a series of media: a brochure, a trailhead sign, a slide and sound exhibit, a television program and a newspaper feature article. Not enough visitors were exposed to the latter two media to evaluate their effectiveness. However, exposure to the slide/sound exhibit, the slide/sound exhibit plus the brochure, and the slide/sound exhibit plus the trailhead sign resulted in significant increases in visitor knowledge. Exposure to the trailhead sign and brochure were not found to be very effective. The study of motorists also found that exposure to two types of information/education media—a brochure and a cassette tape—both increased the knowledge level of respondents.

More recent studies have also found significant effects of information and education programs on visitor knowledge and subsequent behavior. For example, a sample of day hikers to subalpine meadows in Mount Rainier National Park in Washington was given a short, personal interpretive program on reasons for and importance of complying with guidelines for off-trail hiking (Kernan and Drogin 1995). Visitors who received this program and those who did not were later observed as they hiked. Most visitors (64%) who did not receive the interpretive program did not comply with off-trail hiking guidelines, while most visitors (58%) who did receive the interpretive program complied with the guidelines.

Bulletin boards at trailheads have also been found to be effective in enhancing visitor knowledge about low-impact hiking and camping practices (Cole and others 1997b). Wilderness visitors exposed to low-impact messages at a trailhead bulletin board were found to be more knowledgeable about such practices than visitors who were not. However, increasing the number of messages posted beyond two did not result in increased knowledge levels.

Workshops and special programs delivered to organizations can also be effective in enhancing knowledge levels, as well as intentions to follow recommended low-impact practices. The effectiveness of these types of information and education programs have been demonstrated in two studies aimed at Boy Scouts (Dowell and McCool 1986) and a volunteer group associated with the Boundary Waters Canoe Area Wilderness (Jones and McAvoy 1988). In both cases, treatment groups scored higher than control groups on tests of knowledge and behavioral intentions administered immediately after the programs and at a later date. Research also suggests that commercial guides and outfitters can be trained to deliver information and education programs to clients that are effective in enhancing visitor knowledge (Roggenbuck and others 1992; Sieg and others 1988) and that trail guide booklets can also be effective (Echelberger and others 1978).

Not all research has found information and education programs to be as effective as indicated in the above studies. A study of the effectiveness of interpretive programs at Great Smoky Mountains National Park, in North Carolina and Tennessee found mixed results (Burde and others 1988). There was no difference in knowledge about general backcountry policies between backcountry visitors exposed to the Park's interpretive services and those who were not exposed. However, the former group did score higher on knowledge of park-related hazards. A test of visitor compliance rates with campground regulations in Acadia National Park in Maine found no difference between time periods when a special brochure was and was not used (Dwyer and others 1989). Finally, a test of the effect a special brochure on appropriate behavior relating to bears found only limited change in actual or intended behavior of visitors (Manfredo and Bright 1991). Visitors requesting information on wilderness permits for the Boundary Waters Canoe Area Wilderness were mailed the special brochures. In a follow-up survey, only 18% of respondents reported that they had received any new information from the brochure, and only 7.5% reported that they had altered their actual or intended behavior.

Visitor Attitudes—A third category of studies on the potential effectiveness of information and education programs has examined their influence on visitor attitudes toward a variety of management agency policies (Bright and others 1993; Cable and others 1987; Manfredo and others 1992; Nielson and Buchanan 1986; Olson and others 1984; Ramthun 1996; Robertson 1982). These studies have found that information and education programs can be effective in modifying visitor attitudes to become more supportive of recreation and related land management policies. For example, visitors to Yellowstone National Park were exposed to interpretive messages designed to influence their beliefs about fire ecology and the effects of controlled-burn policies (Bright and others 1993). These messages were found to influence both beliefs about fire ecology and attitudes based on those beliefs.

Depreciative Behavior—A fourth category of studies on the potential effectiveness of information and education as a management practice has focused on depreciative behavior, especially littering. A number of studies have found that a variety of information and education messages and related programs can effectively reduce littering behavior and even clean up littered areas (Burgess and others 1971; H. Christensen 1981; H. Christensen and Clark 1983; H. Christensen 1986; H. Christensen and others 1992; Clark and others 1971; Clark and others 1972a,b; Horsley 1988;

Marler 1971; Muth and Clark 1978; Oliver and others 1985; Powers and others 1973; Roggenbuck and Passineau 1986; Taylor and Winter 1995; Vander Stoep and Gramman 1987; Wagstaff and Wilson 1988). For example, samples of visitors to a developed campground were given three different treatments: a brochure describing the costs and impacts of littering and vandalism, the brochure plus a personal contact with a park ranger, and these two treatments plus a request for assistance in reporting depreciative behaviors to park rangers (Oliver and others, 1985). The brochure plus the personal contact was the most effective treatment; it reduced the number of groups who littered their campsite from 67% to 41% and reduced the number of groups who damaged trees at their campsite from 20% to 4%. Types of messages and related purposes found to be effective in a number of studies include incentives to visitors to assist with clean-up efforts and the use of rangers and trip leaders as role models for cleaning up litter.

Other Studies—Several other types of studies, while not directly evaluating the effectiveness of information and education, also suggest the potential of information and education as a recreation management practice. First, studies of visitor knowledge indicate that marked improvements are possible which could lead to improved visitor behavior. For example, campers on the Allegheny National Forest in Pennsylvania were tested for their knowledge of rules and regulations that applied to the area (Ross and Moeller 1974). Only 48% of respondents answered six or more of the ten questions correctly. A similar study of visitors to the Selway-Bitterroot Wilderness Area tested knowledge about wilderness use and management (Fazio 1979a). Only about half of the 20 questions were answered correctly by the average respondent. However, there were significant differences among types of respondents, type of knowledge and the accuracy of various sources of information, providing indications of where and how information and education programs might be channeled most effectively.

Second, several studies indicate that current information and education programs could be substantially improved (Cockrell and McLaughlin 1982; Fazio 1979b; Fazio and Ratcliffe 1989). Evaluation of literature mailed in response to visitor requests has found several areas of needed improvements, including more timely response, more direct focus on management problems and issues, greater personalization, more visual appeal and reduction of superfluous materials.

Third, a survey of wilderness managers has identified the extent to which 25 visitor education techniques are used (Doucette and Cole 1993). Study findings are shown in table 7. Only six of these education techniques—brochures, personnel at agency offices, maps, signs, personnel in the backcountry and displays at trailheads—are used in a majority of wilderness areas. Managers were also asked to rate the perceived effectiveness of education techniques. It is clear from table 7 that personnel-based techniques are generally considered more effective than media-based techniques.

Related studies have examined the sources of information used by outdoor recreation visitors for trip planning (Uysal and others 1990, Schuett 1993). Many respondents report using information sources that are not directly produced by management agencies, such as outdoor clubs, professional outfitters, outdoor stores, guidebooks, newspaper and magazine articles and travel agents. This suggests that management agency linkages with selected private and commercial organizations may be an especially effective approach to information and education.

Studies on information and education as a recreation management practice are relatively numerous, but highly diverse, employing a variety of message types and media and addressing a variety of issues and target audiences. Generally, these studies suggest that information and education can be an effective recreation management practice. Moreover, a number of guidelines for using information and education can be developed from this literature (Roggenbuck and Ham 1986, P. Brown and others 1987, Manfredo 1989, 1992, Roggenbuck 1992, Doucette and Cole 1993, Bright 1994, Basman and others 1996, Vander Stoep and Roggenbuck 1996). These guidelines include:

1. Use of multiple media to deliver messages is often more effective than use of a single medium.
2. Information and education programs are generally more effective with visitors who are less experienced and less knowledgeable. Young visitors may be an especially attractive target audience.
3. Brochures, personal messages and audiovisual programs may be more effective than signs.
4. Messages may be more effective when delivered early in the recreation experience, such as during trip planning.
5. Messages from sources judged highly credible may be most effective.
6. Computer-based information systems can be an effective means of delivering information and education.
7. Knowledgeable volunteers, outfitters and commercial guides can be effective and efficient in communicating information and education to visitors.
8. Information on the impacts, costs and consequences of problem behaviors can be an effective information and education strategy.
9. Role modeling by park and wilderness rangers and volunteers can be an effective information and education strategy.
10. Personal contact with visitors by rangers or other employees, both before and during the recreation experience, effectively communicate information and education.
11. Messages should be targeted at specific audiences to the extent possible. Target audiences that might be especially effective include those who request information in advance and those who are least knowledgeable.

Use Rationing and Allocation—Substantial attention has been focused on the management practice of limiting the amount and/or type of use that parks, wilderness and related areas receive. Use rationing is controversial and is generally considered to be a management practice of "last resort" because it runs counter to the basic objective of providing public access to wilderness and related areas (Behan 1974; Behan 1976; Dustin and McAvoy 1980; Hendee and Lucas 1973; Hendee and Lucas 1974). However, limits on use may be needed to maintain the quality of the recreation experience and to protect the integrity of critical resources.

Table 7—Use and perceived effectiveness of 25 education techniques in wilderness areas (adapted from Doucette and Cole 1993).

Technique	Percentage used	Mean perceived effectiveness rating[a]
Brochures	74	2.5
Personnel at agency office	70	2.7
Maps	68	2.1
Signs	67	2.3
Personnel in backcountry	65	3.8
Displays at trailheads	55	2.6
Displays at agency offices	48	2.7
Posters	48	2.3
Personnel at school programs	47	2.9
Slide shows	36	2.9
Personnel at campgrounds	35	2.9
Personnel at public meetings	34	2.8
Personnel at trailheads	29	3.3
Personnel at visitor centers	26	3.0
Videos	21	2.6
Agency periodicals	18	2.3
Displays at visitor centers	18	2.5
Guidebooks	13	2.5
Interpreters	11	3.6
Computers	11	1.9
Commercial radio	9	1.9
Commercial periodicals	8	2.4
Movies	7	2.6
Commercial television	4	2.3
Agency radio	1	2.4
Mean of personnel-based techniques		3.1
Mean of media-based techniques		2.4
Mean of all techniques		2.6

[a]Effectiveness scale: 1 = "not effective"; 5 = "highly effective"

Use Rationing and Allocation Practices—Five basic management practices have been identified in the literature to ration and allocate recreation use (Fractor 1982; McLean and Johnson 1997; Shelby and others 1989a; Stankey and Baden 1977). These include 1. reservation systems, 2. lotteries, 3. first-come, first-served or queuing, 4. pricing and 5. merit. A reservation system requires potential visitors to reserve a space or permit in advance of their visit. A lottery also requires potential visitors to request a permit in advance, but allocates permits on a purely random basis. A first-come, first-served or queuing system requires potential visitors to "wait in line" for available permits. A pricing system requires visitors to pay a fee for a permit, which may "filter out" those who are unable or unwilling to pay. A merit system requires potential visitors to "earn" the right to a permit by virtue of demonstrated knowledge or skill.

Each of these management practices has potential advantages and disadvantages. For example, reservation systems may tend to favor visitors who are willing and able to plan ahead, but these systems may be difficult and costly to administer. Lotteries are often viewed as eminently "fair," but can also be difficult and costly to administer. First-come, first-served systems may favor visitors who have more leisure time or who live relatively close to a park area, but they are relatively easy to administer. Pricing is a commonly used practice in society to allocate scarce resources, but may discriminate against potential visitors with low incomes. Merit systems are rarely used, but may lessen the environmental and social impacts of use.

Several principles or guidelines have been suggested for considering and applying use rationing and allocation practices (Stankey and Baden 1977). First, emphasis should be placed on the environmental and social impacts of recreation use rather than the amount of use per se. Some types of recreation use may cause more impacts than others. To the extent that such impacts can be reduced, rationing use of recreation areas can be avoided or at least postponed. Second, as noted above, rationing use should probably be considered a management practice of last resort. Less direct or "heavy-handed" management practices would be more desirable where they can be demonstrated to be effective. Third, good information is needed to implement use rationing and allocation. Managers must be certain that social and/or environmental problems dictate use rationing and that visitors are understood well enough to predict the effects of alternative allocation systems. Fourth, combinations of use rationing systems should be considered. Given the advantages and disadvantages of each use-allocation practice, hybrid systems may have special application. For example, half of all wilderness permits might be allocated on the basis of a reservation system and half on a first-come, first-served basis. This would serve the needs of potential visitors who can and do plan vacations in advance, as well as those who engage in more spontaneous trip planning. Fifth,

use rationing should establish a linkage between the probability of obtaining a permit and the value of the recreation opportunity to potential visitors. In other words, visitors who value the opportunity highly should have a chance to "earn" a permit through pricing, advance planning, waiting time or merit. Finally, use-rationing practices should be monitored and evaluated to assess their effectiveness and fairness. Use rationing for recreation is relatively new in many locations and is likely to be controversial. Special efforts should be made to ensure that use-rationing practices accomplish their objectives.

Fairness—A critical element of use-rationing and allocation practices is "fairness" (Dustin and Knopf 1989). Wilderness and related recreation areas administered by federal, state and local agencies are public resources. Use-rationing and allocation practices must be seen as both efficient and equitable. But how are equity, fairness and related concepts defined? Several studies have begun to develop important insights into this issue. These studies have outlined several alternative dimensions of equity and measured their support among the public.

One study identified four dimensions of an overall theory of "distributive justice" (Shelby and others 1989a). Distributive justice is defined as an ideal whereby individuals obtain what they "ought" to have based on criteria of fairness. A first dimension is "equality" and suggests that all individuals have an equal right to a benefit like access to wilderness. A second dimension is "equity" and suggests that benefits be distributed to those who "earn" them through some investment of time, money or effort. A third dimension is "need" and suggests that benefits be distributed on the basis of unmet needs or competitive disadvantage. A final dimension is "efficiency" and suggests that benefits be distributed to those who place the highest value on them.

Insights into these dimensions of distributive justice were developed through a survey of river runners on the Snake River in Hell's Canyon, Idaho (Shelby and others 1989b). Visitors were asked to rate the five use allocation practices described above—reservation; lottery; first-come, first-served; pricing; and merit—on the basis of four criteria: perceived chance of obtaining a permit, perceived fairness of the practice, acceptability of the practice and willingness to try the practice. Results suggest that visitors use concepts of both fairness and pragmatism in evaluating use-rationing practices. However, pragmatism—the perceived ability on the part of the respondent to obtain a permit—had the strongest effect on willingness to try each of the allocation practices. These findings suggest that managers have to convince potential visitors that proposed use allocation practices are not only "fair," but that they will provide them with a reasonable chance to obtain a permit.

A second series of studies has examined a more extended taxonomy of equity dimensions that might be applied to provision of a broad spectrum of park, wilderness and related services (Wicks and Crompton 1986, Wicks 1987, Wicks and Crompton 1987, Crompton and Wicks 1988, Wicks and Crompton 1989, 1990, Crompton and Lue 1992). Eight potential dimensions of equity are identified as shown in figure 10. A first dimension is compensatory and allocates benefits on the basis of economic disadvantage. The second two dimensions are variations of equality and they allocate

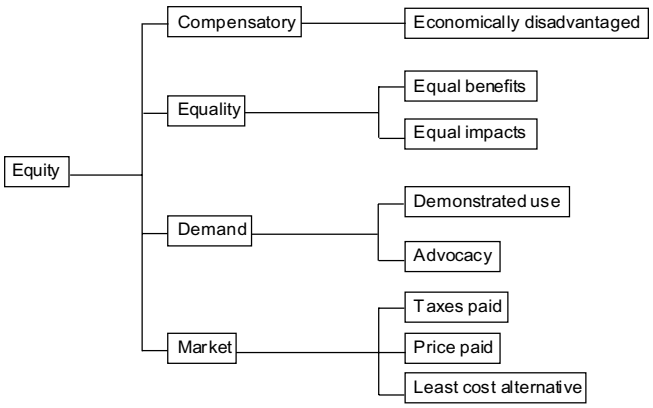

Figure 10—Dimensions of equity for allocating park and recreation benefits (adapted from Crompton and Lue 1992).

benefits to all individuals equally or ensure that all individuals ultimately receive equal total benefits. The fourth and fifth dimensions are based on demand, and they allocate benefits to those who make greatest use of them or those who advocate most effectively for them. The final three dimensions of equity are market-driven and distribute benefits based on amount of taxes paid, the price charged for services or the least-cost alternative for providing recreation services.

These dimensions of equity were described to a sample of California residents, and respondents were asked to indicate the extent to which they agreed or disagreed with each dimension of equity as a principle for allocating public park and recreation services to residents (Crompton and Lue 1992). A majority of the sample agreed with only three of the dimensions. These dimensions were, in decreasing order, demonstrated use, price paid and equal benefits.

Visitor Attitudes and Preferences—Despite the complex and controversial nature of use rationing and allocation, there is considerable support for a variety of such management practices among visitors to wilderness and related areas (Fazio and Gilbert 1974; Glass and More 1992; Lucas 1980; Lucas 1985; McCool and Utter 1981; McCool and Utter 1982; , Schomaker and Leatherberry 1983; Shelby and others 1982, 1989b; Stankey 1973, 1979; Utter and others 1981; Watson 1993; Watson and Niccolucci 1995). Research suggests that even most individuals who have been unsuccessful at obtaining a permit continue to support the need for use rationing (Fazio and Gilbert 1974; McCool and Utter 1982; Stankey 1979). A study of visitors to three wilderness areas in Oregon found that support for use restrictions was based on concerns for protecting both resource quality and the quality of the visitor experience (Watson and Niccolucci 1995). Support by day hikers was influenced most strongly by concerns with crowding, while support by overnight visitors was influenced by concern for both crowding and environmental impacts.

Preferences among alternative use rationing practices have been found to be highly variable, based on both location and type of user (Glass and More 1992; Magill 1976; McCool and Utter 1981; Shelby and others 1982, 1989b). Support for a particular use-allocation practice appears to be related primarily to which practices respondents are familiar with

and the extent to which they believe they can obtain a permit. A study of river managers found that first-come, first-served and reservation systems were judged the two most administratively feasible allocation practices and were also the most commonly used practices (Wikle 1991).

In keeping with the generally favorable attitude toward use limitation described above, most studies have found visitor compliance rates for mandatory permits to be high, ranging from 68% to 97% with most areas in the 90% range (Godin and Leonard 1977a; Lime and Lorence 1974; Parsons and others 1982; Plager and Womble 1981; Van Wagtendonk and Benedict 1980). Moreover, permit systems that have incorporated trailhead quotas have been found to be effective in redistributing use both spatially and temporally (Hulbert and Higgins 1977, Van Wagtendonk 1981, Van Wagtendonk and Coho 1986).

A common precursor to mandatory permit systems in wilderness and related areas is voluntary self-registration. Visitors are asked to register themselves at trailheads as a measure of use for management purposes. Compliance with this management practice has been found considerably less uniform than with mandatory permits: Registration rates have been found to vary from 21% to 89%, with most in the 65% to 80% range (James and Schreuder 1971; James and Schreuder 1972; Leatherberry and Lime 1981; Lucas and others 1971; Lucas 1975; Lucas and Kovalicky 1981; Scotter 1981; Wenger 1964; Wenger and Gregerson 1964). Several types of visitors have especially low registration rates, including day users, horseback riders and single-person parties.

Pricing—Among the use-rationing and allocation practices described above, pricing has received special attention in the literature. Pricing is the primary means of allocating scarce resources in a free-market economy. Economic theory generally suggests that higher prices will result in less consumption of a given good or service. Thus, pricing may be an effective approach to limiting use of wilderness and related areas. However, park, wilderness and recreation services in the public sector have traditionally been priced at a nominal level or have been provided free of charge. The basic philosophy underlying this policy is that access to parks, wilderness and related areas is important to all people and no one should be "priced out of the market." Interest in instituting or increasing fees at wilderness and related areas has generated a considerable body of literature, ranging from philosophical to theoretical to empirical (F. Anderson and Bonsor 1974; M. Anderson and others 1985; Bamford and others 1988; Becker and others 1985; Bowker and Leeworthy 1998; N. Christensen and others 1993; Cockrell and Wellman 1985a, b; Daniels 1987; Driver 1984; Dustin 1986; Dustin and others 1987; Emmett and others 1996; Fedler and Miles 1989; Gibbs 1977; Harris and Driver 1987; Kerr and Manfredo 1991; Leuschner and others 1987; Lundgren 1996; McCarville 1996; McCarville and Crompton 1987; McCarville and others 1986; McDonald and others 1987; Manning and Baker 1981; Manning and others 1984; Manning and Koenemann 1986; Manning and Zwick 1990; Manning and others 1996f; Martin 1986; G. Peterson 1992; Reiling and others 1988, 1992; Reiling and Cheng 1994; Reiling and others 1996; Reiling and Kotchen 1996; Rosenthal and others 1984, Schreyer and Knopf 1984; Schultz and others 1988; Scott and Munson 1994; Stevenson 1989; Walsh 1986).

Studies of pricing have tended to focus on several issues related to its potential as a wilderness management practice. First, to what extent does pricing influence use of parks and wilderness areas? Findings have been mixed. For example, a study of day users at six recreation areas administered by the Army Corps of Engineers found that 40% of respondents reported they would no longer use these areas if a fee was instituted (Reiling and others 1996). However, other studies have shown little or no effects of pricing on recreation use levels (Becker and others 1985; Leuschner and others 1987; Manning and Baker 1981; Rechisky and Williamson 1992). The literature suggests that the influence of fees on recreation use depends on several factors, including:

1. The "elasticity of demand" for a park or wilderness area. Elasticity refers to the slope of the demand curve that defines the relationship between price and quantity consumed. This issue is illustrated in figure 11. The demand for some recreation areas is relatively elastic, meaning that a change in price has a comparatively large effect on the quantity consumed (or visitation). The demand for other recreation areas is relatively inelastic, meaning that a change in price has a comparatively small effect on the quantity consumed (or visitation).
2. The significance of the area. Parks and wilderness areas of national significance, such as Yellowstone National Park, generally have a relatively inelastic demand, suggesting that pricing is not likely to be effective in limiting use unless price increases are quite dramatic. Parks and wilderness areas that are less significant are likely to be characterized by more elastic demand, and pricing may be an effective use-allocation practice.
3. The percentage of total cost represented by the fee. In cases where the fee charged represents a relatively high percentage of the total cost of visiting a wilderness area, pricing is likely to be a more effective use-limiting approach. However, where the fee charged represents only a small percentage of the total trip cost, pricing is not likely to be an effective use-limiting approach.
4. The type of fee instituted. Pricing structure can be a potentially important element in determining the effectiveness of fees as a management practice. For example, a daily use fee might be more effective in

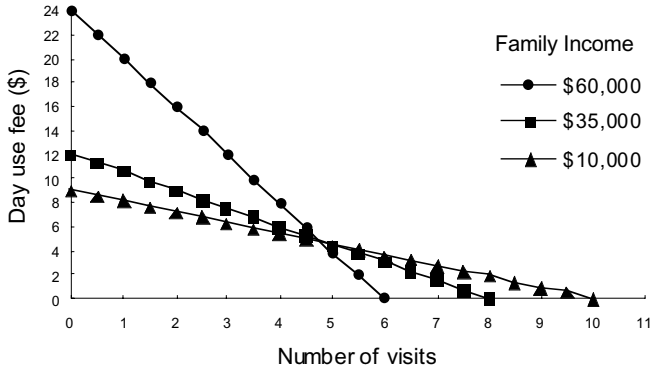

Figure 11—Demand curves for day use recreation areas by income level (from Reiling and others 1996).

limiting total use than an annual pass that allows unlimited use opportunities for a flat fee.

A second issue addressed in the literature is the acceptability of fees to potential visitors. Again, study findings are mixed, although they often suggest that there is a substantial willingness to pay for access to park and wilderness areas. However, research suggests that the acceptability of fees depends at least partially on several factors, including:

1. Dispensation of resulting revenues. If revenues derived from fee programs are retained by the collecting agency and reinvested in recreation facilities and services, fees are often judged to be more acceptable by visitors.
2. Initiation of fee or increase in existing fee. Public acceptance of new fees where none were charged before tends to be relatively low compared to increases in existing fees.
3. Local or nonlocal visitors. Local visitors tend to be more resistant to new fees or increased fees than nonlocal visitors. As described above, this is probably because fees represent a larger percentage of the total cost of visiting a wilderness area for local visitors. Moreover, local residents are likely to visit a given wilderness area more often than nonlocal residents.
4. Provision of comparative information. Visitor acceptance of fees is likely to be greater when information is provided on the costs of competing or substitute recreation opportunities and when visitors are made aware of the costs of providing recreation opportunities.

A third issue concerns the potential for pricing to discriminate against certain groups in society, particularly those with low incomes. Once again, research on this issue is mixed. For example, one study examined the socioeconomic characteristics of visitors to two similar outdoor recreation areas in Virginia, one of which charged an entrance fee, and the other did not (Leuscher and others 1987). No differences were found in income levels, suggesting that the fee had no discriminatory effect. However, two studies of willingness to pay fees at state parks and Army Corps of Engineers day-use areas found that lower income visitors had a more elastic demand curve than did high-income users, as illustrated in figure 11 (Reiling and others 1992, 1994). This suggests that pricing may discriminate against lower income visitors.

A final issue concerns the use of differential pricing to influence recreation use patterns. Differential pricing consists of charging higher or lower fees at selected times and locations. It was noted earlier that outdoor recreation tends to be characterized by relatively extreme "peaking." That is, certain areas or times are used very heavily, while other times or areas are relatively lightly used. Can pricing be used to even out such recreation use patterns? Research suggests the potential of this use of pricing (LaPage and others 1975; Manning and others 1982; Willis and others 1975). For example, studies of experimental differential campsite pricing at Vermont state parks documented significant shifts in campsite occupancy patterns (Manning and others 1984, Bamford and others 1988).

Other Wilderness Recreation Management Practices—As suggested earlier in this section, a number of other practices are available to manage wilderness recreation. Most tend to be direct management practices. Beyond information/education programs and limiting use, four broad categories of management practices addressed in the literature include 1. rules and regulations, 2. law enforcement, 3. zoning and 4. site design and management.

Rules and Regulations—Rules and regulations are commonly used recreation management practices, although their use can sometimes be controversial (Lucas 1982, 1983). Common applications of rules and regulations in outdoor recreation include group size limitations, assigned campsites and/or travel itineraries, area closures, length of stay limitations and restrictions on and/or prohibition of campfires. The importance of encouraging visitors to comply with rules and regulations is emphasized in a recent study of the national park system, which found that visitors who did not comply with rules and regulations caused extensive damage (Johnson and Vande Kamp 1996).

As noted earlier in this section, research indicates that visitors are often unaware of rules and regulations (Ross and Moeller 1974). This suggests that managers must effectively communicate rules and regulations to visitors using the principles and guidelines described in the section on information and education programs. In particular, visitors should be informed of the reasons why applicable rules and regulations are necessary, sanctions associated with failure to comply with rules and regulations, and alternative activities and behaviors that can be substituted for those not allowed.

Only limited research has addressed the effectiveness of rules and regulations as a recreation management practice. The literature suggests that most visitors support limitations on group size, but that group types should also be considered when promulgating such regulations (Heywood 1985; Roggenbuck and Schreyer 1977). Group size limits should not be set so low that they affect the primary social groups of visitors who may have strong motivations for social interaction. However, research indicates that social groups in wilderness areas tend to be small.

Research also suggests that regulations requiring the use of assigned campsites in wilderness or backcountry are generally not supported by visitors (D. Anderson and Manfredo 1986; Lucas 1985). An extreme version of this regulation requires backpackers to follow a fixed travel itinerary. Studies of the effectiveness of this regulation have found that visitor compliance rates are relatively low (Parsons and others 1981, 1982; Stewart 1989, 1991; Van Wagtendonk and Benedict 1980). For example, 44% to 77% of backcountry campers were in full compliance with their permit itinerary across four zones of Grand Canyon National Park (Stewart 1989). Noncompliance was primarily caused by visitors using campsites other than those specified or staying in the backcountry more or fewer nights than originally specified.

Research on regulations closing selected areas to public use suggest they are supported by visitors if the underlying reason is clear and justified (Frost and McCool 1988). Most visitors would obey a regulation closing selected backcountry campsites for ecological reasons (Cole and Rang 1983). Regulations closing areas to camping in selected natural areas in Norway were also found to be effective, although the

effects of such regulations can substantially threaten traditional use and users (Vork 1998). This suggests that regulations should be used cautiously.

Law Enforcement—Little research has been conducted on law enforcement in outdoor recreation. Most of the literature in this area discusses the controversial nature of law enforcement in this context (Bowman 1971; Campbell and others 1968; Connors 1976; Hadley 1971; L. Harmon 1979; Heinrichs 1982; Hope 1971; Manning 1987; Morehead 1979; Perry 1983; Philley and McCool 1981; Schwartz 1973; Shanks 1976; Wade 1979; Westover and others 1980; Wicker and Kirmeyer 1976). However, one study focused on the use of uniformed rangers to deter off-trail hiking at Mount Rainier National Park (Swearingen and Johnson 1995); the presence of a uniformed ranger significantly reduced off-trail hiking. Moreover, visitors tended to react positively to this management practice when they understood that the ranger was needed for information dissemination, visitor safety and resource protection.

Zoning—Zoning is another basic category of recreation management practices. In its most generic sense, zoning simply means assigning certain recreation activities to selected areas (or restricting activities from areas, as the case may be). Zoning can also be applied in a temporal dimension as well as in a spatial sense. Finally, zoning can be applied to alternative management prescriptions as a way to create different types of outdoor recreation opportunities (Greist 1975, Haas and others 1987). For example, "rescue" and "no-rescue" zones have been proposed for wilderness areas, though this is controversial (Dustin and others 1986; Harwell 1987; McAvoy and Dustin 1983; McAvoy and others 1985; McAvoy 1990; D. Peterson 1987).

In its most fundamental form, zoning is widely used to create and manage a diversity of recreation opportunities. The basic concept of zoning is at the heart of the Recreation Opportunity Spectrum described earlier in this paper. Zoning is also used in outdoor recreation to restrict selected recreation activities from environmentally sensitive areas and to separate conflicting recreation uses. No primary research has been conducted on the potential effectiveness of zoning.

Site Design and Management—A final category of wilderness management practices is site design and management. Recreation areas can be designed and manipulated to "harden" them against recreation impacts and manage the use made of them. For example, boardwalks can be built to concentrate use in developed areas, and facilities can be constructed along trails to channel use in appropriate areas (Doucette and Kimball 1990; Hultsman and Hultsman 1989). Moreover, campsites can be designated and designed in ways to minimize social and ecological impacts (Echelberger and others 1983; Godin and Leonard 1976; McEwen and Tocher 1976). However, most of these management practices involve resource management activities that are beyond the scope of this paper. Moreover, such resource management practices may not be in keeping with the environmental protection objectives of wilderness areas. Hammitt and Cole (1998) and a companion paper in this proceeding by Leung and Marion provide excellent reviews of the outdoor recreation literature addressing site and resource management.

Status and Trends in Wilderness Management

What recreation management practices are used most often, and how effective are they? What are the trends in wilderness recreation management? Several studies conducted over the past two decades offer insights into these questions (Godin and Leonard 1979, Bury and Fish 1980, Fish and Bury 1981, Washburne 1981, Washburne and Cole 1983, Marion and others 1993, Manning and others 1996a). These studies have focused on wilderness and backcountry areas and have involved periodic surveys of recreation managers. The most recent study explored current recreation management practices in the national park system (Marion and others 1993, Manning and others 1996a). Managers of all national park backcountry areas were asked to indicate which of more than 100 recreation management practices were currently used and which were judged most effective. Management practices used in over half of all areas are shown in table 8, along with all management practices judged to be "highly effective."

Comparisons across these studies can provide some insights into trends in recreation management problems and practices, at least in the context of wilderness and backcountry areas. Although the areas, management agencies and research methods varied among these studies, their primary objectives were similar—to assess recreation management problems and/or practices in resource-based recreation areas. These studies provide benchmarks at four points in time—1979, 1981, 1983 and 1993—and suggest several basic trends in wilderness recreation management problems and practices.

First, environmental impacts, primarily on trails and campsites, are the dominant recreation-related problems perceived by managers throughout these studies. In all four studies, managers tended to report site deterioration, including soil erosion and loss of vegetation, as the most frequently occurring recreation management problem.

Second, social problems of crowding and conflicting uses appear to have increased over time. The initial study in 1979 revealed no crowding problems. The study reported that user conflict was cited as a problem by 29% of wilderness managers, but this conflict was associated primarily with nonconforming uses of wilderness, such as grazing and off-road vehicles. More recent studies report substantial and increasing levels of crowding and conflict among recreation users. For example, crowding was reported as a problem "in many places" in 1983 at 10% of all areas studied, including 2% of National Park Service areas. By 1993, between 10% and 27% (depending upon location—campsite, trail, attraction site—within the area) of National Park Service areas reported crowding "in many or most areas." Moreover, conflict between different types of users was reported as widespread in 2% of areas in 1983, but it was reported as a problem "in many or most areas" in 1993 by as many as 9% of areas.

Third, carrying capacity has become a pervasive but largely unresolved issue. The initial study in 1979 did not report carrying capacity as a significant issue. However, by 1983, recreation use was judged to exceed carrying capacity "sometimes" or "usually" in at least some areas by over half

Table 8—Most commonly used and effective recreation management practices (adapted from Manning and others 1996a.)

Most commonly used (% of areas using)	Most effective
Educate visitors about "pack-it-in, pack-it-out" policy (91)	**Campsite impacts**
Prohibit visitors from cutting standing deadwood for fires (83)	Designate campsites
Educate visitors about how to minimize their impacts (77)	Prohibit campfires
Remove litter left by visitors (74)	Provide campsite facilities
Instruct visitors not to feed wildlife (74)	Restore campsites
Require backcountry overnight visitors to obtain permits (68)	Limit group sizes
Instruct visitors to bury human wastes (66)	Implement campsite reservation system
Require groups to limit their length of stay at campsites (64)	**Trail impacts**
Give verbal warnings to visitors who violate regulations (63)	Maintain and rehabilitate trails
Require groups to limit their size (62)	Use Impact monitoring system
Prohibit pets from the backcountry (61)	Use formal trail system and plan
Prohibit use of horses in selected areas (59)	Implement quotas on amount of use
Instruct visitors to bury human wastes away from all water sources (57)	**Wildlife impacts**
Inform visitors about potential crowding they may encounter in selected areas (56)	Temporarily close sensitive areas
	Regulate food storage and facilities
Discourage use of environmentally sensitive areas (54)	Provide user education programs
Inform visitors about managers' concerns with visitor use impacts at attraction areas (54)	Restrict pets
	Provide information workshops for
Instruct visitors to view wildlife from a distance (53)	Commercial outfitters and guides
Perform regular trail maintenance (52)	**Water impacts**
Require groups to limit their length of stay in the backcountry (51)	Provide primitive toilets at high-use sites
	Visitor crowding and conflicts
	Implement quotas on amount of visitor use
	control access to backcountry with visitor transportation system

of all managers. Carrying capacity problems in National Park Service areas were reported as equally extensive in 1983 and 1993, with 70% of managers reporting that carrying capacity is exceeded either "sometimes" or "usually" in at least some areas. Despite the apparent seriousness of the carrying capacity issue, most managers have not yet addressed it adequately. Nearly half of all areas studied in 1983 reported that they were unable to estimate carrying capacity for any portions of their areas. Moreover, the percentage of National Park Service areas unable to estimate carrying capacity rose from 36% in 1983 to 57% in 1993. Finally, despite the fact that 43% of National Park Service areas currently are able to estimate carrying capacity in at least some portions of their areas, considerably less than half of these areas make such estimates based on scientific studies.

Fourth, implementation of both direct and indirect recreation management practices have tended to increase over time. For example, overnight permits for backcountry camping were required by 41% of areas in 1983, but were required by 68% of areas in 1993. Party size limits have been imposed in increasing numbers of areas, up from 43% in 1981 to 62% in 1993. Length-of-stay limits are also imposed in increasing numbers of areas, up from 16% in 1981 to 51% in 1993. Finally, minimum-impact education programs were employed in 77% of areas in 1993, up from 35% reported in 1981. Although some of these differences may be the result of differences among management agencies, the magnitude of the differences suggests a shift in management practices.

Fifth, day use is an emerging issue that warrants more management attention. The study in 1983 was one of the first to report that a very large percentage of all wilderness-related recreation use was accounted for by day users. The average percentage of all visitor groups that are day users ranged from 44% in Bureau of Land Management areas to 83% for Fish and Wildlife Service areas. In National Park Service areas, the percentage of day users has remained relatively constant over the past decade: 62% in 1983 and 64% in 1993. The issue of day use is exacerbated by two factors (Roggenbuck and others 1994). First, managers attribute many management problems to day users. In fact, in the judgment of managers, day users are more responsible than overnight visitors for most types of management problems. Second, day users often are not targeted for management actions. For example, only 8% of National Park Service areas require a permit for day use.

Finally, management of outdoor recreation is becoming more complex and more sophisticated. This trend is reflected in the nature of the four studies examined in this section. The original study in 1979 was primarily an exploratory study asking managers to describe their primary problems. The basic concept of wilderness areas emerged as a primary issue while managers struggled with the legal and operational definitions of wilderness and related areas. The second study, reported in 1981, focused primarily on recreation management practices across several land management agencies. The third study, in 1983, adopted several objectives, including determining recreation use patterns,

recreation-related problems and recreation management practices. The fourth and most recent study incorporated the preceding objectives and added others, including investigating the perceived causes of management problems, the effectiveness of management practices and the degree to which management actions are based on scientific study. The progression of these four studies illustrates that awareness and knowledge about recreation-related problems and management practices are expanding.

Studies on alternative park and wilderness recreation management practices are beginning to be marshaled into handbooks and other types of guidelines that can be used by managers. In addition to suggesting which recreation management practices might be applied to a series of recreation-related problems, a handbook on wilderness management developed by the U.S. Forest Service offers basic information on understanding and applying each of the 37 recreation management practices identified (Cole and others 1987). A similar handbook has been developed for use by managers of national parks and related areas (D. Anderson and others 1998). Prototypes of computer-based "expert systems" are also being developed to provide recreation managers with guidance based on the scientific literature (Flekke and others 1996).

However, research suggests that recreation management is influenced by managers and the agencies they represent, as well as the expertise available to them (Bullis and Tompkins 1989; Dennis and Magill 1991; Driver and Brown 1984; Holland and Beazley 1971; Kaufman 1960; Kennedy 1985, 1987a,b; Magill 1988; Twight and Lyden 1988, 1989; Van Meter 1988). For example, a survey of recreation managers on several national forests in California found that most were educated in the natural resources fields of study that have traditionally emphasized commodity production rather than the social sciences (Dennis and Magill 1991). Moreover, most managers reported that their training in recreation management had occurred "on the job," suggesting that traditional professional orientations and management practices were being perpetuated. Finally, the administrative structure of the management agency was found to provide relatively few opportunities for professional advancement for managers educated in the social sciences. These findings suggest that many of the social science-based issues in wilderness recreation may be difficult to address under traditional administrative structures.

Finally, wilderness management can be influenced by personal philosophy as well. A study of wilderness managers in the Southwest found that the personal wilderness philosophy of managers influenced the types of wilderness management practices undertaken (Virden and Brooks 1991). For example, managers who favor a stronger biocentric orientation to wilderness may be more likely to adopt direct recreation management practices such as regulating visitor behavior. A study of wilderness visitors has found similar relationships between environmental values and philosophy and support for wilderness management practices (Valliere and Manning 1995, Manning and Valliere 1996). These findings suggest that managers and others concerned with recreation management and related matters should be encouraged to develop thoughtful professional philosophies through academic and professional education.

Directions for Wilderness Recreation Research and Management

The research reviewed and synthesized in this paper suggests several directions for future wilderness recreation research and management. These directions include the following:

1. Indicators and standards of quality provide a useful framework for formulating wilderness management objectives and defining the quality of wilderness recreation experiences. However, additional research is needed to help identify and define a broad range of indicators of the quality of wilderness recreation experiences. Most research to date has focused on crowding-related standards of quality, and this is in keeping with the emphasis on solitude defined by the Wilderness Act. However, research suggests that the quality of wilderness recreation experiences is multidimensional, and a broader array of potential indicators of quality should be defined.
2. Research on standards of quality has relied primarily on normative theory and techniques. Findings from such studies have provided a stronger empirical basis for defining the quality of wilderness recreation experiences and setting appropriate standards of quality. However, this research should be supplemented with other theoretical and empirical approaches. In particular, research is needed to address the inherent trade-offs between standards of quality and pubic desire for unimpeded access to wilderness areas.
3. Research and management attention is needed on monitoring indicators of quality. Monitoring of indicator variables is an inherent and important part of contemporary park and wilderness recreation management frameworks. Monitoring determines when and where management action is needed to maintain standards of quality. However, monitoring can be time-consuming and costly, and it can challenge the personnel and financial resources of wilderness management agencies. There is little guidance to be found in the wilderness management literature on cost-efficient and effective monitoring approaches and techniques.
4. More research should be conducted on the potential effectiveness of wilderness management practices. As described in this paper, a wide range of management practices is available to maintain standards of quality. However, most research has focused on the effectiveness of only two basic management approaches: information/education programs and use rationing/allocation. While these are important management approaches and deserve continued research attention, other management practices warrant additional attention, including rules and regulations, law enforcement, zoning and site design and management.
5. The literature reviewed in this paper suggests that wilderness recreation research and management are conducted largely in isolation from one another. It may be productive to link these activities more closely.

Wilderness managers are faced with a host of recreation-related issues and respond with a variety of management practices. Designing and conducting this management approach within a more deliberate research framework might enhance learning opportunities for both managers and researchers and ultimately lead to more informed wilderness management. This closer collaboration between managers and researchers would more fully meet the spirit of the contemporary concept of adaptive management.

6. The studies reviewed in this paper suggest that there is a relatively large and growing scientific literature on defining and managing wilderness recreation experiences. However, this literature is inherently diverse and spread over a wide academic and scholarly landscape. More effort needs to be devoted to organizing and synthesizing this literature. These efforts should be designed to guide future research and provide more informed guidance to wilderness managers.

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Wilderness Use in the Year 2000: Societal Changes That Influence Human Relationships With Wilderness

Alan E. Watson

Abstract—The purpose of this paper is to extend a synthesis of knowledge about wilderness visitors and their visits developed in 1985. At that time, visitor research was in decline, and there was very little ability to understand trends. Over the last 15 years, wilderness visitor research has been initiated at many places in the U.S. where no previous studies had been completed. There have also been several studies specifically aimed at providing comparisons over time. Although review of these studies has concluded that very little has changed about how we describe visitors, their visits or their preferences for management, limited data suggest that the way visitors relate to wilderness has changed and will continue to change well into the next century.

The National Wilderness Preservation System has been in existence in the United States since 1964, and we sometimes struggle still to interpret the intentions of the people who negotiated, crafted and fought to enact this legislation. While recreational values were considered important, protecting intact ecosystems also influenced the selection of places included in our national system. It is time to stop and ask ourselves how the people of this and future generations will relate to the wild parts of our landscape. Is the function of wild places in the lives of people today the same as it was in 1964? Will it remain the same into the future? What do we know about how this relationship has been changing, what has caused it to change, and how might we expect it to change in the future?

These questions form the purpose of this paper. First of all, we need to look back at the previous effort, in 1985, to summarize existing knowledge about wilderness use and users. Roggenbuck and Lucas (1987) reviewed existing wilderness visitor studies at that time, and they offered a summary of the knowledge they were able to glean from this examination. They also pointed out some knowledge gaps and made suggestions for future research. It is important to return to this review in order to appreciate where we stand today and discern important research topics for the future. Besides discussing some of the important points made by Roggenbuck and Lucas (1987), we also have the ability to describe how wilderness science has evolved in response to knowledge generated at that time. From this information, we should be able to understand the importance of conducting wilderness visitor research and what the priority topics should be. We should also be able to develop some understanding of how and why human relationships with wilderness have changed and will continue to change in the U.S.

Wilderness User Research in 1985 and 1999

In 1985, at the first and only previous National Wilderness Reseach Conference, Roggenbuck and Lucas (1987) summarized the knowledge gained from their examination of reports from about 23 different wilderness studies conducted between 1960 and 1983. I use the term "about" because some of the studies they reviewed were conducted before we had a National Wilderness Preservation System, and some of the studies they reviewed were not conducted in protected wilderness, even after the recognition of our wilderness system in 1964. For example, Boundary Waters Canoe Area visitors were studied in 1960 and 1961 (the Boundary Waters was officially recognized as wilderness with passage of the Wilderness Act in 1964), and Great Smoky Mountain National Park visitors were surveyed in 1976 and 1983, although there is no federal wilderness acreage inside the Park to date. They also included data taken from Appalachian Trail hikers who passed through National Forest lands in the Southern Region of the National Forest System in 1970 and 1971 and Baxter State Park visitors in Maine in 1979. While different studies made different contributions to the results they included, their report indicates that they extracted information from a total of 32 different studies, some in wilderness and some not in wilderness.

Before they summarized the findings from these studies, Roggenbuck and Lucas (1987) depicted the difficult times that wilderness visitor research was experiencing in the early 1980s. By their reckoning, use and user research was less common at the time of their summary than it had been a decade earlier. In reflecting over the short history of wilderness science, the good old days of the late 1960s and early 1970s were gone, and "...wilderness visitor surveys became scarce after the middle 1970s and nearly disappeared in the 1980s." They were particularly concerned over the lack of knowledge about wilderness visitors in the East, the South, the Desert Southwest and California. Reflecting the lack of funding resources and the apparent decline of wilderness visitor research, these well-known wilderness researchers expressed concern that "...without further comparable studies our knowledge of trends will remain extremely skimpy."

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I'm pleased to inform these wilderness science leaders that things are looking up a little. In a quick search of the library shelves at the Aldo Leopold Wilderness Research Institute, I noted that just since 1988, the year after the earlier summary was published, there have been at least 25 studies of wilderness visitors with sufficient depth to contribute to a general understanding of use and user characteristics at specific sites. Most of these studies, as with the studies summarized by Roggenbuck and Lucas (1987), extended beyond descriptive studies of use and users to contribute to understanding of attitudes, preferences, behaviors and evaluations of conditions encountered in wilderness. Partially as a result of the gap in information emphasized in the earlier summary, notable progress has taken place in conducting studies in the South, in California and in the East. These are only the studies that have been funded or somehow sponsored by the Leopold Institute; there have been many more conducted by other organizations to fill in gaps in knowledge about wilderness use. As Roggenbuck and Lucas noted with concern in their earlier summary, however, none of these more recent studies were aimed at establishing knowledge about trends in use or users. It seems that most of our resources have continued to be dedicated to development of new knowledge about previously unstudied areas.

The Exceptions: Studies of How Human Relationships With Wilderness Have Changed

Fortunately, there is more good news for our distinguished scientists of the previous decade. Included in the summary by Roggenbuck and Lucas (1987) was some speculation about how use and users seemed to be changing. Remember, most of these observations came from looking at about 23 wilderness studies conducted during the previous 20 years at a variety of places. They did take advantage of a recent study by Lucas (1985) aimed at determining user trends at the Bob Marshall Wilderness Complex in Montana (studies in 1970 and 1982). Unfortunately, that was the only wilderness study with those objectives available at that time. There have been several comparative studies since.

In 1990 and 1991 Cole and others (1995) conducted three studies specifically to provide information on trends in wilderness recreation use and users. Three very different types of wilderness were selected, in different parts of the country, but they all depended on the existence of previous studies to provide comparison. All three were included in the original summary of knowledge by Roggenbuck and Lucas (1987). At the Desolation Wilderness in California, a study in 1990 was intended to provide comparisons to studies by Lucas (1980) and Stankey (1980), conducted in 1972. Previous research at Shining Rock Wilderness in North Carolina in 1978 (Roggenbuck and others 1979; Roggenbuck and others 1982) was repeated in 1990. The third study was in the Boundary Waters Canoe Area Wilderness in 1991, repeating a study by Stankey (1971, 1973) conducted in 1969.

Another type of comparison study, conducted in 1993 (Watson and others 1996), had a very different intent. The purpose of this study of visitors to the Eagle Cap Wilderness in Oregon was to look at trends related to users of the area, but it concentrated more on trends in commitment to wilderness and attitudes toward some specific wilderness camping and traveling behaviors. The original Eagle Cap study for comparison was in 1965 (Hendee and others 1968), just one year after passage of the Wilderness Act, and it was one of the studies summarized in the 1985 summary of knowledge about wilderness users.

Trends in Wilderness Use and User Characteristics

Roggenbuck and Lucas (1987) drew several qualified conclusions from looking at the data they had to examine, mostly from the 1960s and 1970s. They were able to conclude that the group of visitors under age 35 was the most common and that the age structure of visitors did not seem to be changing. They noted that males were consistently the large majority, but sensed that female visitors may be increasing in proportion. Also noticeable were the increasing education of visitors and the consistently above-average incomes of visitors, although they would not have been described as wealthy.

The studies at the Desolation, Shining Rock and Boundary Waters Canoe Area (Cole and others 1995), and the Bob Marshall comparative study (Lucas 1985), concluded that only five of 83 variables studied across all four areas changed substantially and consistently. Three of those were user characteristics.

Contrary to what Roggenbuck and Lucas (1987) were observing in data compiled in 1985, visitors in the 1990s were consistently and significantly older than users from earlier studies. The most common age group was now between 35 and 40 years. Visitors were more highly educated than previously, as was evident in the earlier studies. In fact, as high as 40% to 50% had some graduate level college education. This would compare to about 8% in California and 6% in Minnesota and North Carolina, according to the 1990 census. Proportions of the population with graduate level college education were so low at the time of earlier studies that they were not recorded or not published in generally available sources for comparisons. These percentages are not exactly comparable due to differences in age restrictions for the sample and census counts, but the magnitudes are so extremely different that it is easy to see that the increase in educational attainment among wilderness visitors greatly exceeds the pace for the general population, where earlier population estimates are available. The proportion of females visiting wilderness has increased significantly across all areas studied, as earlier speculated, with some estimates as high as 35% of the visiting public.

One demographic descriptor that did not differ substantially and consistently across all four data sets, but which did show somewhat weak, but consistent changes, was income. Generally, income increased across studies; it never went down for any of the study groups. More recent studies, however, have generated some curiosity about the dilemma over the extremely high incomes of some segments of wilderness visitors. In the Frank Church–River of No Return Wilderness, Hunger and others (in press) found that nearly

half of the dominant user group of the river system inside the wilderness—the commercial river floaters, which are about two-thirds of the floater population—report annual household incomes of over $100,000, compared to about 12% of noncommercial floaters reporting this income level. While Roggenbuck and Lucas (1987) refuted the charge that wilderness is accessible only to the very wealthy, this information on commercial river floaters suggests that, at some places for some types of access, the very wealthy are the dominant users. Gilbert and Kolh (summarized in Hurst 1998) reported that in 1990, only 15% of the U.S. population had household incomes above $70,000 per year. This knowledge, linked with recent understanding of the casual nature of the relationship between the commercial customer and the wilderness resource (low experience levels, low self-evaluation of skills and lack of accurate expectations teamed with discordant evaluations of conditions encountered (high expectations for primitive conditions, positive evaluations of nonprimitive conditions encountered)) raises questions about the tradeoffs between perceptions of the high values of introducing casual wilderness users to intense wilderness experiences and the social costs associated with mixing casual and intense wilderness visitors on the same wilderness resource. Management policies which are influenced by commercial enterprises catering to this segment of the user public are possibly contributing more to rural economic development goals than the goal of providing wilderness experiences (Hunger and others, in press).

Roggenbuck and Lucas (1987) also observed that party size was small at most places studied, and the studies they reviewed suggested a decrease in average party size across areas. They acknowledged that while horse groups and river rafters appeared to be traveling in larger groups than wilderness hikers, two- to four-person groups seemed the most common. They also observed that length of stay was short, with day trips dominating, and trips seemed to be getting shorter. Cole and others (1995), however, found no visit characteristic that changed substantially and consistently. Things like the proportion of organized groups in wilderness, the proportion of visitors traveling with family members, the activities they participated in while in wilderness, the number of groups they reported encountering in the wilderness and the difficulty they had in finding acceptable campsites did not change. Neither did length of stay nor group size. In one place where managers believed the opposite to be happening (—that is, nonsystematic observation led to assumptions that group size was creeping up over the years—), careful analysis of trend data found tremendous fluctuation and not consistent trends to allow the conclusion that party size had changed at all for river user groups on the Middle Fork of the Salmon River in the Frank Church–River of No Return Wilderness (Becker and others, in press), although total annual use has consistently increased.

In general, the admittedly limited number of studies specifically designed to detect changes in use and user characteristics concluded that nothing much has changed. The characteristics of the visitors haven't changed very much, the trips they take haven't changed very much, and even the preferences they expressed for management of the wilderness are not very different from those they expressed about 20 years earlier (Cole and others 1995).

So What Has Changed?

The study of Eagle Cap visitors (Watson and others 1996) may be the more critical study of trends, not just because it did find differences in many variables, but because of the types of variables included in the two comparative studies. Hendee and others (1968) concluded from their 1965 study of Eagle Cap visitors that when visitors held strong wilderness values, these values were the product of (among other things) higher than normal educational attainment and membership in one or more conservation or outdoor organizations. These authors encouraged the stewards of the new National Wilderness Preservation System to become more aware of the social processes underlying trends in wilderness use and how these trends may influence the values which visitors ascribe to wilderness.

By 1993, wilderness visitors to the Eagle Cap had exhibited changes similar to those described above from other visitor trend studies. They were older, with the age category 35 to 54 increasing from about half to two-thirds of visitors surveyed, and more highly educated. However, contrary to inconsistent findings from other studies, these users demonstrated significantly higher membership in conservation or outdoor recreation organizations (25% in 1965, 44% in 1993). The length of wilderness stays and the amount of time spent in wilderness each year had not changed.

As predicted back in 1965, these substantial increases in education and membership in conservation or outdoor recreation organizations paralleled changes in attitudes and commitment toward wilderness. While we may have incorrectly speculated that many things have changed about wilderness visitor and visit characteristics, we would all probably have correctly assumed that their attitudes toward wilderness have changed. But no one knew how much these things had changed. We see from Watson and others (1996) that the changes were substantial and always in a positive direction. Current visitors exhibit much more purist attitudes about wilderness behavior, and they express much stronger wilderness values than visitors did shortly after passage of the Wilderness Act. For example, in 1965, 87% of the visitors surveyed thought it was okay to bury noncombustible trash in the wilderness. By 1993, only 9% expressed this belief. Similarly, about one-fourth thought it inappropriate to bring radios into the wilderness in 1965, while two-thirds were against radios in the wilderness in 1993. Even the three-fourths that felt a campfire was necessary during wilderness trips dropped to only one-third in 1993.

Comparisons to the baseline study by Hendee and others in 1965 resulted in knowledge that the proportion who believed we should allow lightning-caused fires to burn changed from only 3% to 44% by 1993. Livestock grazing was supported by 17% in 1965 and only 9% in 1993, and visitors who feel that hunting is incompatible with wilderness objectives increased from one-third to one-half.

These attitudes toward wilderness values and behaviors are clearly examples of the things we should be monitoring among wilderness visitor characteristics. The attitudes and values associated with wilderness protection appear to be related to visitor characteristics such as education and active membership in conservation or outdoor recreation organizations, and it is the change in attitudes that may

truly drive the purpose and process of wilderness protection in the future. While Roggenbuck and Lucas (1987) lamented that studies of wilderness visitors aimed at "…topics more closely related to visitor experiences and behaviors…are assigned higher priority" than those aimed at describing use and user characteristics, in hindsight it now appears that much more research should have been targeted to track changes in these indicators of the relationship between people and wilderness.

Why Have Values and Attitudes Changed?

Watson and Landres (1999) have offered some thoughts on why wilderness plays a different role in society today, how wilderness values will continue to change into the future and how management and policy are related to wilderness values (figure 1). What makes wilderness different today from what it was in 1964, when legislators and interest groups came together in agreement about what was to be protected at that time, is that it just isn't 1964 anymore. Why would we expect the forces that drove creation of this national wilderness preservation system to be exactly the same today? Basic wilderness philosophy aside, we need to stop a minute and think about what has changed and see if it gives us insight into why wilderness values have changed and how they might change in the future. This model suggests that the things that are changing about our society, as well as some specific things we have done to protect the wilderness resource, are major influences on the attitudes (values) people have about wilderness and it is these collective values that lead to legislative action and management policies. The meanings attached to wilderness experience represent the ways we value wilderness and contribute to attainment of higher order benefits that, in turn, drive societal change and specific actions.

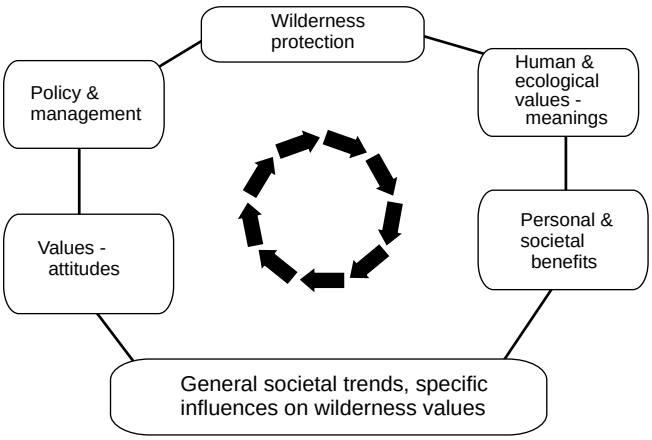

Figure 1—Influences on human relations with wilderness (adapted from Watson and Landres 1999).

Societal Influences

First of all, there are things that have changed about the society we all live in that also change the way we relate to wilderness. This relationship is different from 1964, and it is even different from 1985. Some of the ways our society has changed include changes in our culture, technological advances, environmental changes and diversification in the economy.

Changes in Culture—Our society is already dominated by an urban culture, and this domination is only going to increase. Stokes (1999) expressed the belief that population growth and urbanization are two of the four most important contributors to change in the political environment surrounding wilderness issues. Not only do we see the physical changes involved with the transition of farm and ranch lands to housing, businesses and roads, but our society has transformed to an urban culture, complete with changes in racial and ethnic mix, increasing education and income and an increasingly important dependence upon others to affect change. Wirth (1972) predicted that urbanism was going to create a feeling of inability to influence change on the part of the individual. This would precipitate the need to join with others of similar interests into organized groups to obtain ends. Today, in Missoula, Montana, the urgency to protect a dwindling supply of open space in the urban area is represented by the acronym of the organized conservation group Save Open Space (S.O.S.). Membership is largely composed of urban residents trying to exert some control over a valued, threatened natural environment by mustering community support.

Carlson and McLeod (1978) found that among farmers, those with higher education, higher income and a shorter involvement in farming held weaker agrarian philosophies, obviously characteristics associated with an urbanizing society. A New York Times poll of 1989 found that the third most popular activity among domestic U.S. vacationers was visiting small towns. Some researchers believe that urban residents value the rural landscape more than rural residents do. If increasing urbanization leads to increasing value associated with undeveloped landscape, and undeveloped landscape is diminishing, the way to accomplish protection of undeveloped landscapes is to join others with similar interests; increased association with others interested in protecting landscapes leads to even more purist attitudes toward protection, and even stronger wilderness attitudes would be expected in the future, as they have developed in the recent past.

Technology Advances—In John Naisbitt's (1982) first book on megatrends, he projected that through the end of this century, we would continue to feel the effects of a switch from an industrialized society to an information society. We are living more and more in an economy and a society built on information. This has driven us en masse toward redefining power and quality of life. In the computer age, we are forced to deal with conceptual space rather than physical space. Back in 1964, it was easy to understand the meaning of Bob Marshall's statement that "Certain vigorous people gain intense satisfaction in doing for themselves all the tasks essential for existence." That fit well with the image of primitive skills needed to enjoy wilderness travel and camping and the values of society at that time. Today, that statement is more aptly applied to the skills necessary to survive our increasingly technology-oriented society. It is

the person with instant access to the World Wide Web, a cellular telephone and the most efficient computer software who has the essentials for existence in our society. The wilderness resource has become more and more of a contrast to the effects of dominant societal values. As the continuum continually extends toward the technology end, the primitive end becomes more valuable to society as a point from which to compare and understand the benefits and threats technology offers to society. While not essential to physical existence, the novelty of wilderness skills, the opportunity to deal with physical space and the need to verify knowledge about natural places make the role of wilderness today a different one from the past.

Environmental Change—As an urbanized and educated society, we are much more aware of environmental threats and changes today than ever before. Ancient civilizations may have lived in closer harmony, but we are constantly bombarded by new information about the threats our lifestyles pose to the environment. From the time of industrialization, we have constantly become more of a threat to the environment, but now we have endless options to reduce our impacts. We have changed everything from our deodorants to our vehicle air conditioners to protect the ozone layer. Our attitudes toward beef and the fast-food restaurants that prepare it in quantity have changed due to relationships between tropical deforestation and agriculture. Activism, or even passive support, of efforts to protect the environment are positive character attributes of members of our society. Methods to protect the environment have become major issues of debate in modern political campaigns, and we find countries competing in the international forum to be leaders in environmental protection.

Diversification of the Economy—The economy of a society based on information is based on a resource that is not only renewable but self-generating. This information-based economy is much less dependent on commodity extraction, and we have developed a good understanding of how natural amenities influence the local tax base and the local economy (Power 1996). In 1960, about 21% of nonmetropolitan jobs in the U.S. were in the extractive industries. By 1985, that was down to only 8%. Power (1996) describes this transition from a set of "core" extractive industries to an expanded and diversified economy during this century. He points out that lands with wilderness qualities are a relatively scarce resource with significant alternative uses. Wilderness protection does not impoverish communities by locking up resources. Rather, it protects the economic future of communities by protecting high quality natural environments that are increasingly in demand across the nation.

Specific Influences

Watson and Landres (1999) also suggest that some specific things have likely contributed to changes in attitudes toward wilderness. These would include things that have increased awareness about impacts caused by recreation, media coverage of natural ecological processes, increased scientific understanding of natural processes and noticeable loss of protected natural areas.

Awareness of Impacts Caused by Recreation—The Leave No Trace program, originally developed by the U.S. Forest Service in the 1970s, has been embraced by the Bureau of Land Management, the National Park Service, the U.S. Fish and Wildlife Service and a broad range of outdoor user groups. In addition, it is gaining support from the recreation industry and has formally organized as a nonprofit organization (Swain 1996). LNT recently empowered young, enthusiastic teams of people to travel throughout the U.S. in Subarus packed with Leave No Trace educational brochures and souvenir first aid kits, evidence of corporate sponsorship to support spreading the word about how you can reduce your impacts on the natural environment while hiking, rafting and bicycling. Generally, wilderness education programs are aimed at school age children, with the hope of impressing them with the importance of taking care of the limited natural places we have. The Wilderness Impact Monster program (Hendricks and Watson 1999, Hendricks, in press), started in Oregon in association with the Eagle Cap Wilderness, has spread to many places in the U.S. as a method of making young and old more aware of wilderness etiquette and our responsibility to take care of the wilderness environment. These and other agency- and corporate-sponsored programs have been aimed specifically at changing some of the attitudes and values we know have changed for wilderness visitors and the public.

Media Coverage of Natural Ecological Processes—National and regional coverage of the role of fire in natural ecosystems after the large fires of 1988 is believed to have influenced public perceptions of the value of fire. Barraged by Smokey Bear slogans and the belief that fire is bad, the American public awoke in the 1980s to find scientists proclaiming the need for fires to correct many years of fire exclusion policies. In a study by Manfredo and others (1990), a strong relationship was found between knowledge about fire effects and support for policies that allowed some fires to burn in places where they did not pose threats to safety or property. In the Rocky Mountain West, where recent occurrence of wildland fires had dominated the media, knowledge about fire effects, and therefore support for policies to let some fires burn, was higher than in other parts of the U.S.

Increased Understanding of Natural Processes—Today, we have much greater understanding of natural processes and their importance than we did in earlier decades. The terms "biodiversity," "habitat fragmentation" and "ecosystem management" are not used and understood only by scientists or in academic circles. The way we think and talk about the landscape has been shaped by specific advances in scientific understanding about the interrelationships among parts of our environment. Rachel Carson was writing *Silent Spring* as the debate over wilderness protection was occurring. Today, we are extremely aware of the effects of toxic chemicals on our environment and human health. We are also constantly changing the way we look at wild places due to new knowledge about the effects of fish stocking on native amphibians (Matthews and Knapp 1999), the effects of non-native species on biodiversity (Asher and Harmon 1995) and the effects of recreation on natural animal populations (Gutzwiller and others 1998). The United States is considered the super science power of the world. We are the biggest and most effective science producer of all the

countries. The United Kingdom comes closest, with an estimated 18% of U.S. science development; Japan is 12%, Russia is estimated at 3%, Italy and Sweden at 4% and India at 1%. Our understanding of natural processes and the effects of our behaviors on the environment continue to change rapidly.

Loss of Protected Natural Areas—While the National Wilderness Preservation System has increased since 1985, the amount of undeveloped places has generally decreased. Scarcity naturally increases the value of natural landscapes in an urban society that is rapidly developing its unprotected places. As the landscape changes, movements to save open space, to protect greenways and to expand protected areas increase. Wetland development, offshore mineral exploration and tourism development are all proceeding at a rapid pace, contributing to the threat of depletion of unexplored, undeveloped places in the U.S. A growing awareness of increasing scarcity has affected the value of natural landscapes to many people.

The Future

Some of the societal and specific influences that are going to change our relationship with wilderness in the next century include continued urbanization of our culture, increasing technology and information availability and the potential commercialization of wilderness resources and experiences.

Continued Urbanization

As our urban centers merge together and traditional U.S. rural values continue to subside, a greater proportion of wilderness visitors will both grow up and continue to reside in urban situations. With urbanization comes expectations of higher incomes, higher educational attainment and a tendency to join organizations to influence change, including protecting natural landscapes. While these visitors will have less frequent exposure to nature and less familiarity with the skills needed to deal with wilderness travel, they may find the switch from dealing with conceptual space to physical space as novel as recent past generations found the reverse situation. Recent reports of substantial social and economic benefits of wilderness experience programs on urban, economically disadvantaged youth (Russell and others 1998) only provide a glimpse of the potential value of wilderness protection to increasingly urban populations. One of the great research questions is the need to understand how increasing urbanization will influence wilderness values in the future. Speculation suggests that the more urban we become, the more valued will be the primitive landscape from which we originated.

Technology and Information

Vice President Al Gore once said "We are at the present time woefully unprepared to grapple with the serious ethic choices with which the new technology will confront us. The very power to bring about so much good will also open the door to serious potential problems." While genetic cloning, new surgical techniques and medications and alternative energy sources were probably foremost in his thoughts, his concerns apply equally to the increasing effects of technology and information on wilderness. In the future, it will continue to be easier to find wilderness than it was in the past, the likelihood that one will be able to do more indepth planning of wilderness trips while seated at the computer at home will increase, and the presence of technological devices that directly conflict with the purpose of being in wilderness will increase substantially. As this technology invades every aspect of wilderness exploration, we will face the serious need for development of an "information ethic," just as we were once in need of a "land ethic." One of the reasons people go to wilderness is for the sense of discovery and uncertainty.

In a study of Desolation Wilderness users in 1997-1998 that asked visitors to rank 19 potential uses of recreation fees, providing access to existing information posted on the Internet/World Wide Web about the Wilderness was ranked 15th and 17th for two independent samples of campers and 18th and 19th for two independent samples of day users (Vogt and Williams, in press). This may be interpreted to mean these visitors dislike the existing information about the Wilderness, they lack Internet access or they recognize the inappropriateness of so much available information about a wild place. Much of the risk and adventure can be taken away by the availability of electronic information such as photographic images of campsites or vistas, fish stocking history of lakes and streams and recent human visitation levels. Aldo Leopold once lamented that unknown places disappear as a dominant fact in human life. It may take society's discovery of the last uncharted place (and "posting it on the web") to understand what such discovery takes away.

Commercialization of Wilderness Resources and Experiences

The single greatest threat to the relationship that has evolved between the American people and wilderness is the recent trend toward charging fees for access to wild places on public land. More (in press) argues that imposing fees for access to public lands may not be consistent with the interests of the general public. Instead, commonly used willingness-to-pay pricing approaches to establish fee policies pushes public policy toward the preferences of the affluent in our society. For Desolation Wilderness visitors, responses to new and additional proposed fees were associated with user perceptions that these fees would limit access for some segments of society (Watson and others 1998). While existing restrictions on participation in wilderness recreation—such as trailhead quotas, limits on river float permits, etc.—) have mostly been perceived as fair to all potential participants, the introduction of fees changes the function of wilderness in the lives of the American people, with the most profound effects expected on the relationships between wilderness and the American working class (More, in press).

Fees could also change the relationship between the American people and the agencies charged with managing wilderness. More (in press) is concerned that current strategies for implementing recreation fees on public lands are serving the interests of the agencies more than they are serving the

public. Winter and others (in press) provide context for the importance of this concern by presenting arguments that social trust may be the most significant predictor of anticipated impacts of new fees, general attitudes toward recreation fees, and amounts people are willing to pay for recreation access. While Winter and others (in press) report that the expected impact of fees is more likely to be in the form of reduced spontaneity than exclusion, there is no doubt that it will change the values associated with wilderness.

One of the most basic effects of charging fees for wilderness access will be the perception of commercialization, or treating the wilderness as a commodity, even by members of the public who agree in principle with charging user fees (Trainor and Norgaard, in press). And we expect substantial displacement effects due to fees (Schneider and Badruk, in press). The existence of fees at some areas, even if we develop a policy that charges for all public land access, will influence whether people participate in outdoor recreation and where they go. Future analyses of use and user characteristics, like this one, will not be directly comparable to previous summaries, mostly because of the effects of this one major change in public policy.

Future Research on Wilderness Visitors

Future wilderness visitor research should focus more on the effects of urbanization, technology, and information and communication on the way people use and value wilderness. As a result of recent and anticipated changes in society and some specific things that influence how the American people will relate to wilderness in the future, there are several new issues that should commonly be addressed in visitor surveys. Here are some examples of information needs that should be considered; most have not been included in the past:

1. Did the visitor pay a fee? How many times during the past year did the visitor pay a fee to visit wilderness? How do fees affect the amount of time spent in wilderness, the number of wildernesses visited and the way visitors feel about wilderness?

2. How well do the visitors feel that the Forest Service (or National Park Service, Bureau of Land Management or Fish and Wildlife Service) represents their personal values related to wilderness?

3. Did the visitor bring a cellular phone on the trip? Did the visitor bring a global positioning system on the trip?

4. Did the visitor obtain information on the Internet about the wilderness, beyond how to get there? Does the visitor have Internet access at home? Has the visitor ever accessed the Internet page for a specific wilderness or a national forest to obtain wilderness information?

5. What is the annual household income (in categories defined to provide better documentation of high income group participation) of the visitor? How many people are in the household?

6. Did the visitor come to this wilderness as a member of a private party, a commercially guided party or an institutional group?

7. What conservation or outdoor recreation organizations currently list the visitor as a member?

8. Does the visitor come to the wilderness for functional, emotional or symbolic reasons?

9. What ecological values does the visitor ascribe to wilderness protection?

Wilderness research is not in decline as it was in the middle of the 1980s. In fact, it is occurring at a more rapid rate than it was at that time. There remains, however, a tendency for scientists to inititate wilderness studies at places where no previous research had occurred, instead of conducting followup studies at places with baseline information available. When wilderness visitor populations have been examined for changes in characteristics of users or their trips, very few changes were found. Currently there is a need for more trend studies, but not simply of descriptive characteristics of the people who visit wilderness and their trips. We need to better understand the values they associate with wilderness and the forces in society that are leading to changes in those values. In research studies of the future we need to ask questions which provide us with greater understanding of visitor attitudes toward technology, commercialization of wilderness experiences, public trust, socioeconomic influences and personal meanings ascribed to wilderness visits. This knowledge will provide us with greater insight into how the attitudes of the American people toward wilderness are changing and the meanings that wilderness protection are likely to provide.

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2. Wilderness Visitors

How do Visitor Density and Anthropogenic Change in Frontcountry Wilderness Settings Affect Recreation Benefits?

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Abstract—Effects on recreation benefits were assessed using questionnaires and image sets depicting visitor density ranges and anthropogenic setting changes at two heavily-visited wilderness sites. Visitor benefits were less affected by high visitor densities at the more accessible of the two sites. New age medicine wheels had a positive effect on visitor benefits, as did trail revegetation. Although wilderness visitor density guidelines are frequently exceeded at both sites, wilderness designation is defended as acceptable, because frontcountry wilderness borders buffer less accessible backcountry areas from excessive impacts, and provide inexperienced and casual visitors with non-mechanized recreation experience opportunities, and exposure to wilderness.

Research summarized in Driver and others (1991) and applied using a research and management framework called benefits-based management, or BBM (Lee and Driver 1999) has demonstrated the wide variety of benefits humans receive from interaction with amenity resources, such as experiences in wilderness areas. Recreation benefits are defined as the "realization of desired and satisfying on-site psychological experiences; changes that are viewed to be advantageous or improvements in condition (psychological and physiological) to individuals, to groups, to society…and the prevention of worse conditions" (Bruns and others 1994). Quantifiable physical fitness benefits are most strongly supported by empirical research, but restorative benefits, improved ecological awareness and learning, strengthened social bonds, spiritual and achievement benefits have also been consistently identified. The ability to attain benefits may be affected by recreation experience quality. Commonly used indicators and standards for quality are based on visitor density and anthropogenic change, such as biophysical impacts in wilderness recreation settings (Manning and others 1996).

The Sedona District of Coconino National Forest surrounds the town of Sedona, Arizona, and has one of the highest recreation uses of any district in the entire National Forest System. Vistas of red sedimentary rock formations, unique plant communities, interesting prehistory and outstanding opportunities for primitive recreation characterize the district, which includes the Red Rock-Secret Mountain and Munds Mountain Wildernesses. Experienced by more than a quarter of million people each year, these are the two most visited wildernesses in Arizona (USDA Forest Service 1997a). Meeting the intent of the Wilderness Act is problematic for managers due to the proximity of wilderness boundaries to urban developments and roads, high numbers of visitors and the presence of a thriving tourism industry.

Background and Methods

We investigated the effects of increasing visitor density and a site-specific type of anthropogenic setting change on recreationists' ability to attain benefits at each of two heavily visited front country wilderness attraction sites near Sedona in summer and fall 1996 and spring 1997. *Devils' Bridge* is a large sandstone arch in the Redrock-Secret Mountain Wilderness accessed from a Sedona suburb via a 3 km dirt road and 1.5 km trail; the more easily accessed *Bell Rock* is a 100-meter tall sandstone formation located just inside the Munds Mountain Wilderness boundary only 200 meters from the main gateway highway into the Sedona area.

Site-specific sets of photograph-based images, digitally modified to portray a range of visitor densities and a pair of human-caused biophysical setting variables, were used with a written questionnaire in on-site visitor surveys. We used pictures to illustrate study variables because humans obtain most environmental information through visual perception (Gibson 1979). Photo-realistic portrayals provide better consistency in what visitors are responding to than verbal or written versions of the same information, facilitating more accurate and direct responses (Chenoweth and Gobster 1986). Pictures thus allow more direct relation of respondent assessments to actual features of the landscape than verbal descriptions, and manipulation of a single variable in images that are the same in all other aspects allows reliable attribution of causal affect to that variable (Vining and Stevens 1986). Our methodology was similar to that of Manning and others (1996), who used sets of computer-manipulated, photo-realistic portrayals to assess acceptability of a range of biophysical impacts and visitor density levels at principal attraction sites in Arches National Park.

To construct our image sets, 35mm slides of recreationists in the Sedona area and moderate wide-angle photos of Devil's Bridge and Bell Rock (for use as base or background

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images) were imported into image manipulation software. Individual and small groups of foot travelers in the images were masked and saved as separate clips, then digitally pasted in various numbers and combinations onto copies of the base image for each site, producing sets of photo-realistic visitor density scenarios with identical backgrounds. Digital files for each image were converted to 7"x 10"color photographic prints, mounted in random order on fabric-covered pieces of plywood (so they could be presented simultaneously) and re-randomized after approximately 30 respondents had looked at them. A similar method was used to prepare and display images of biophysical changes at Devil's Bridge and Bell Rock.

The first kilometer of Devil's Bridge Trail (formerly used by off-road vehicles) is devegetated. Small-scale efforts to revegetate this portion of the wilderness access have been made in the past. We investigated potential effects of ecological restoration on ability to attain benefits at Devil's Bridge using a set of four images showing the roadsides incrementally more revegetated to a more trail-like condition.

At Bell Rock, we investigated the effect of seeing a 3m ring of stones called a medicine wheel on benefits. We used an image pair depicting an identical scene with, and without a medicine wheel visible. Originally part of Plains Indian culture, and possibly related to their knowledge of astronomy (Eddy 1974) medicine wheels have been adopted by the Sedona "new age" community and like-minded visitors as symbols of their own spiritual beliefs (Lee and Tainter 1996). Dismantling new medicine wheels when they are constructed in wilderness areas is a substantial and ongoing task for area managers.

For our survey questionnaire, specific benefits described by previous researchers (Bruns and others 1994; Driver and others 1991; Driver and Peterson 1986; Pierskalla 1996) were consolidated into seven benefit groups from which respondents were asked to choose one as most valuable:

RESTORATIVE BENEFITS
-feel more of a sense of freedom
-feel exhilaration/excitement
-reduce feelings of depression or anxiety
-reduce feelings of tension or stress

LEARNING
-learn more about the natural history of the area
-learn more about the cultural history of the area
-develop/express my creativity

STRENGTHEN SOCIAL BONDS
-feel closer to my friends
-bring my family closer together
-feel more independent
-spend time with people who share my values

SPIRITUALITY
-feel stronger spiritually
-gain a sense of peace and serenity
-experience a oneness with nature and the cosmos

RELATIONSHIPS WITH NATURE
-increase my understanding of the natural environment
-increase my awareness of the natural environment
-be in a wilderness area

PHYSICAL FITNESS/EXERCISE
-feel healthier
-improve my overall sense of wellness
-improve my cardiovascular condition

ACHIEVEMENT
-improve my skills and abilities
-challenge myself

Manfredo and others (1996) note the importance of assessing recreation experience preferences as closely as possible to the time of interest. We contacted visitors when benefits they were accruing (or expected to) were presumably very salient: upon their return to site access points from short-duration (usually two hours or less) excursions into wilderness areas. Respondents evaluated the conditions portrayed in each image on a seven-point Likert scale for *effect on their ability to attain their most valued recreation benefit.* Surveys were administered to one person per group of visitors, during all times of day and week over a several-month period, producing broadly representative samples.

Results

Aspects of respondents common to both sites were at least some college education and a 2 to 1 ratio of out-of-state to in-state residents. All respondents were foot travelers and most cited day hiking as their most enjoyable activity, although spiritual activities were also significant at Bell Rock.

Devil's Bridge

Devil's Bridge is a day use area; 75% of respondents stayed two hours or less and another 24% stayed between two and six hours. Eighty-four percent listed day hiking as their most enjoyable activity. Among benefits attained while recreating at Devil's Bridge (table 1), 36% of respondents valued relationships with nature most, followed by restorative benefits (25%) and physical fitness/exercise (22%).

Figure 1 shows mean ability to attain benefits at Devil's Bridge by number of visitors. Increasing visitor density was negatively correlated with ability to attain benefits.

Figure 2 shows effects on ability to attain benefits of trail width at Devil's Bridge. Trail 1 is an unmodified image of the trail as it currently exists; trail 2, trail 3 and trail 4 are the same image with progressively more vegetation added along the sides of the trail. Visitors were most able to attain benefits under the most revegetated, trail-like condition, indicating that ecological restoration efforts here would increase visitor benefits.

Table 1—Devil's Bridge site: benefit valued most, N = 107.

Benefit type	Percentage of total
Relationships with nature	35.5
Restorative	25.2
Physical fitness/exercise	21.5
Spirituality	9.3
Strengthen social bonds	6.5
Learning	1.9
Achievement	0
Total	100.0

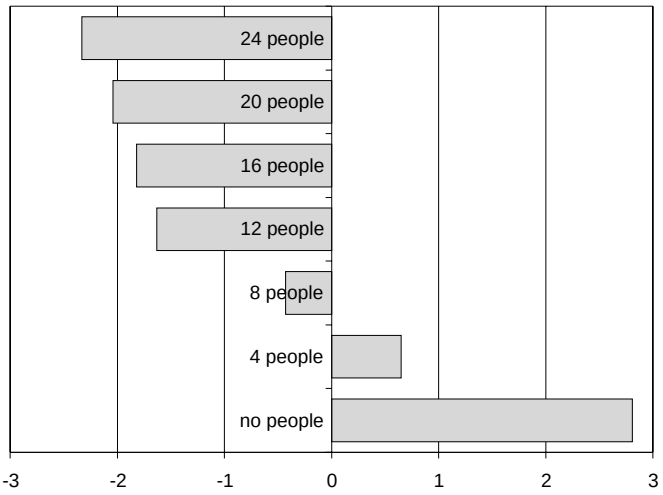

Figure 1—Devil's Bridge site mean effect on ability to attain benefits by visitor density[1, 2, 3], N = 107.

[1] Ratings on a 7-point Likert scale, -3 = very negative effect, 0 = no effect, +3 = very positive effect (on ability to attain most valued recreation benefits).

[2] Differences in ability to attain benefits were statistically significant at each increment of increasing visitor density, Wilcoxon signed rank tests, one-tailed $p < .01$.

[3] Correlation (Kendall's *tau-b*) between visitor density and ability to attain benefits: -.62, one-tailed $p < .001$.

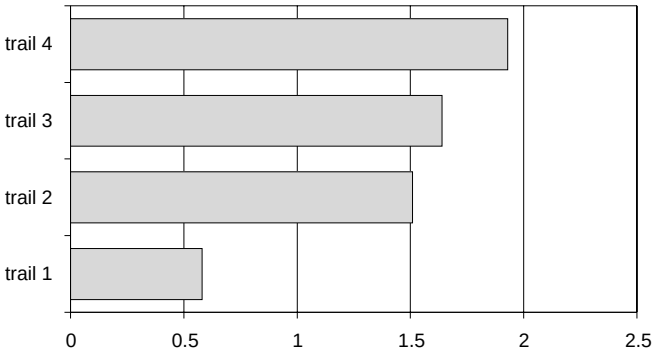

Figure 2—Devil's Bridge site mean effect on ability to attain benefits by trail width[1, 2, 3], N = 107.

[1] Ratings on a 7-point Likert scale, -3 = very negative effect, 0 = no effect, +3 = very positive effect (on ability to attain most valued recreation benefits).

[2] Differences in ability to attain benefits were statistically significant between trail 1 (unmodified image of jeep road) and trail 2 (first increment of revegetation), and between trail 3 (second increment of revegetation) and trail 4 (third increment of revegetation, the most "trail-like" condition). Wilcoxon signed rank tests, one-tailed $p < .01$.

[3] Correlation (Kendall's *tau-b*) between amount of trail revegetation and ability to attain benefits: .23, one-tailed $p < .001$.

Bell Rock

Day hiking was the most enjoyable activity for 43 percent of respondents, followed by spiritual activities (26%) and photography (10%). Thirty-one percent of respondents cited restorative benefits as most valuable, followed by spiritual benefits (26%), relationships with nature (14%) and strengthened social bonds and physical fitness/exercise (11% each). See table 2.

Table 2—Bell Rock site: benefit valued most, N = 80.

Benefit type	Percentage of total
Restorative	31.3
Spirituality	26.3
Relationships with nature	13.8
Strengthen social bonds	11.3
Physical fitness/exercise	11.3
Learning	5.0
Achievement	1.3
Total	100.0

Figure 3 shows mean ability to attain benefits at Bell Rock by number of visitors. Respondents were less able to attain benefits at each increment of increasing visitor density. Figure 4 shows mean effect on benefits for the medicine wheel image pair. Respondents were significantly more able to attain recreation benefits when they did not see a medicine wheel than when they saw one, although both scenarios were evaluated positively.

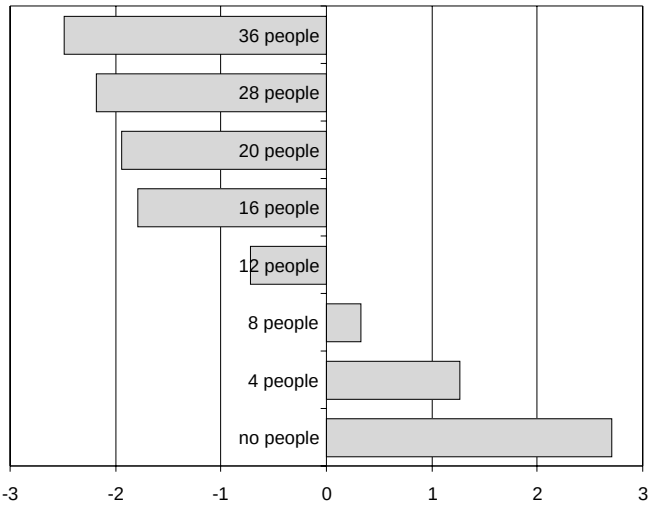

Figure 3—Bell Rock site mean effect on ability to attain benefits by visitor density[1,2, 3], N = 80.

[1] Ratings on a 7-point Likert scale, -3 = very negative effect, 0 = no effect, +3 = very positive effect (on ability to attain most valued recreation benefits).

[2] Differences in ability to attain benefits were statistically significant at each increment of increasing visitor density (Wilcoxon signed rank tests, one-tailed $p < .01$) except for 16 by 20 people, and 20 by 28 people comparisons, $p = .013$ and .011 respectively.

[3] Correlation (Kendall's *tau-b*) between visitor density and ability to attain benefits: -.58, one-tailed $p < .001$.

Discussion

Devil's Bridge

Results for visitor density at Devil's Bridge show that increases in negative effect on ability to attain benefits were greatest between 8 and 12 people visible at one time (fig. 1). Mean Likert-scale ratings dropped below negative one (a moderately negative effect on ability to attain benefits) at a

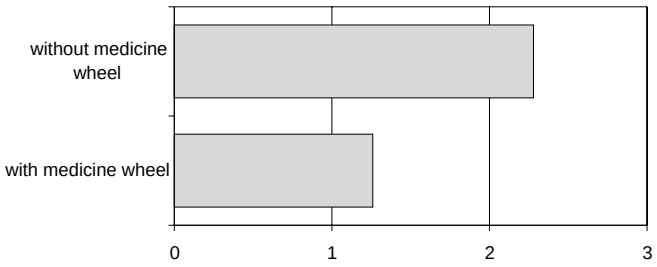

Figure 4—Bell Rock site mean effect on ability to attain benefits for medicine wheel image pair[1, 2], N = 80.

[1] Ratings on a 7-point Likert scale, -3 = very negative effect, 0 = no effect, +3 = very positive effect (on ability to attain most valued recreation benefits).

[2] Difference in ability to attain benefits for scenarios with and without a medicine wheel visible was statistically significant. Wilcoxon signed rank test, one-tailed $p < .01$.

density of about 10 people, which we propose as a potential management standard. This density was rated well above the lowest rating of *very negative* for effect on benefits and was also the point beyond which ratings became significantly *more* negative. The Sedona District's proposed group size limit is 12 in designated wilderness areas (USDA Forest Service 1997a).

Greater ability to attain benefits under trail-width than road-width conditions at Devil's Bridge is consistent with Kaplan and Kaplans' (1989) findings of higher preference for natural scenes in general, and for trees in particular. Preference for outdoor scenes is related to the presence and amount of human artifacts in them (Peron and others 1998), and although scenes described as natural are not restricted to wilderness, people are more likely to respond to a scene as natural if human-built features are absent or not prominent (Ulrich 1983). The most positively rated image in this set (trail 4) also contains the informational factor *mystery*, which has been found to often be a significant predictor variable for preference of natural scenes. Mystery is defined as "...the promise of further information if one could walk deeper into the scene," such as a "...bend in a path and a brightly lit area that is partly obscured by foreground vegetation." (Kaplan and Kaplan 1989).

Bell Rock

Bell Rock is adjacent to Sedona's principal gateway highway, making the site easy to find and attractive to casual, inexperienced visitors. In contrast, locating Devil's Bridge Trail requires good directions and willingness to drive 3 km on a rough dirt road, making it more of a destination for visitors consciously seeking a primitive setting, and less subject to spontaneous, unplanned visits. Results for visitor density at Bell Rock show that increase in negative effect on benefits was largest between 12 and 16 people visible at one time (figure 3). Mean Likert-scale ratings dropped below negative one at around 14 people visible at one time. This is our suggestion for a management standard, and is a substantially higher density of visitors than was considered acceptable by the Devil's Bridge respondents, presumably because the more accessible and easy-to-locate Bell Rock site attracts less experienced visitors. As Hall and Shelby (1996) note, experienced visitors are more likely to have established encounter norms and to make the effort to avoid areas of high visitor density, and are generally less tolerant of encounters than inexperienced visitors.

The construction of medicine wheels at Bell Rock is a phenomenon related to the romanticization and cooptation of Native American cultures by some Sedona residents, visitors and tourism businesses, and conflation of native beliefs with tenets of the so-called "new age" movement. Over the past 15 years, Sedona has acquired a reputation as a new age center, enhanced through marketing by local merchants and tour operators. One local guidebook lists Bell Rock as a particularly strong *vortex,* "...a place where the very fabric of the Universe is distorted in a manner that allows power from the dimension of pure energy to 'leak through' into our dimension." The guidebook provides direction maps and detailed instructions on how to access this "…dynamo of cosmic energy…" at Bell Rock, as well as an interpretation of the medicine wheel ceremony and how to choose a spot to build one (Dannelley 1989).

Many Native American people view building medicine wheels out of their original context as disrespectful to indigenous cultures (LaDuke 1990, Laxson 1991). Since they are not part of the natural landscape and are not genuine artifacts of native habitation or related to present-day native ceremonial practices, local Forest Service and volunteer personnel expend considerable effort dismantling medicine wheels, particularly in wilderness areas.

Our results for the medicine wheel image pair suggest that seeing a *single* medicine wheel may not strongly detract from ability to attain benefits at Bell Rock. However, if Forest Service personnel didn't actively dismantle medicine wheels, visitors to Bell Rock might easily encounter several over the course of a recreational experience. About 14% of respondents thought the medicine wheel portrayed either was, or may have been constructed by Native Americans, and rated seeing the medicine wheel as having a more positive effect on benefits than not seeing it, understandable if they thought it was a genuine Native American artifact. When these respondents are excluded from the sample, differences in ability to attain benefits with and without the medicine wheel visible are somewhat more pronounced, although effects on benefits were still positive in both cases.

This issue needs to be treated carefully by area managers. In our survey at Bell Rock, the scenario with a visible medicine wheel was rated as having a positive effect on benefits, and several respondents interpreted the questions concerning medicine wheels as evidence that local managers were misguided about, blind or even hostile to native land ethics. In this regard, Laxson (1991) observes that many Americans, faced with the excesses of modern society, are curious about native spiritual beliefs, which are perceived to encompass less destructive relationships with the natural world (Callicott 1982). Cartwright and Burns (1994) state that implementation of sustainable ecosystem management will require a much more ecologically knowledgeable population, and numerous authors (for example, Booth and Kessler 1996, Jostad and others 1996) have cited the potential of Native American land ethics to provide guidance for moving toward more ecologically attuned wildland management and decision-making.

The linkage between environmental sensitivity and interest in Native American land ethics is admittedly complex.

However, by speaking directly to the commonalities many visitors see here, managers could further the cause of greater ecological literacy, increase visitor knowledge of Southwestern native cultures and mitigate potentially adverse public reaction to removal of medicine wheels.

Conclusions

Restorative, relationships with nature, physical fitness and spiritual benefits were most valued by respondents. Increases in visitor density had a progressively more negative effect on ability to attain these benefits. For each site, the density of visitors in images producing mean evaluations of –1 (analogous to a moderately negative effect on ability to attain most valued benefits) was suggested as a management threshold. Although the two sites were ecologically and aesthetically similar, our suggested maximum visitor density thresholds for them differed significantly: 10 people at one time for Devil's Bridge versus 14 people at Bell Rock. Location differences between the sites in relation to gateway roads in the area, and consequent variation in visitor types, help explain this discrepancy.

Sedona area managers acknowledge the shortage of primitive settings (using a standard ROS classification) across the forest, despite great demand for them, but they are forced to manage more intensively because visitation at both Devil's Bridge and Bell Rock greatly exceeds the standard for primitive designation (USDA Forest Service 1997b). Thus, landscape settings are managed for primitive qualities, but managerial settings are more consistent with a rural classification. Even under these conditions, we argue that wilderness designation has merit. Although desired density standards are commonly exceeded, providing largely natural settings free of motorized and mechanized travelers allows many inexperienced, less discriminating visitors to gain the benefits of interaction with wilderness and more of an appreciation for it. Moreover, allowing wilderness borders to be designated near heavily traveled front country settings buffers core areas of wilderness from more intensive use. Permitting visitation standards to be exceeded at these sites may attenuate ecological degradation of less disturbed areas, by not displacing visitors to them. The actions necessary to bring visitation standards within primitive classification at Devil's Bridge, and especially at Bell Rock, would be restrictive and costly, using resources perhaps better allocated to less used and impacted places more likely to benefit from managers' attention (Cole and McCool 1997).

Efforts to mitigate anthropogenic changes would augment visitor benefits at both sites. The most revegetated condition had the most positive effect on benefits at Devil's Bridge, and visitors to Bell Rock would rather not see medicine wheels, supporting the current policy of dismantling them. However, failure to acknowledge the positive aspects of visitor interest in native culture, ritual and land ethics could stifle acquisition of this potentially important type of visitor benefit. Thus, we suggest on-site visitor education that includes: 1) an explanation of the inappropriateness of building medicine wheels in wilderness areas; 2) a discussion of differences between Southwestern and Midwestern Native cultures, and 3) acknowledgement of certain commonalities between Native American land ethics and ecosystem approaches to land management.

Finally, our study supports the use of computer-manipulated, but photo-realistic images to assess human perceptions and opinions about environmental variables. Visual presentation of alternative scenarios holds great promise for generating usable information about perceptions of wilderness visitors.

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Noise Impact Issues on the Great Walks of New Zealand

Gordon R. Cessford

Abstract—This paper describes the features of recreational noise impacts and presents examples from popular New Zealand backcountry trails. Some noise effects were noticed at very high levels, and a varied range of tolerance for these was noted. Aircraft noise provided the most extreme impact example, while noise impacts from motorboats and social behaviour in huts were also notable. The need for more active management cooperation with authorities managing adjacent airspace and waterways is emphasised. Research on links between noise effects and social conflict perceptions is recommended.

New Zealand has an extensive system of national parks and other protected areas covering almost 30% of its land area. The Department of Conservation (DOC) manages these diverse areas primarily for protection of their intrinsic natural and historic resources. Subject to this primary conservation goal, DOC is also required to foster the use of these lands for public enjoyment and appreciation. It does this primarily through providing a visitor-support framework based on over 10 000 km of managed trails, 1 000 accommodation huts, and 250 formal campsites with toilet and water facilities. The bulk of these facilities are encompassed in backcountry recreation settings, and the types of recreation opportunities available are predominantly wilderness-based. The DOC visitor groups mainly catered for there are the remoteness-seekers and backcountry adventurers (Department of Conservation 1996, Cessford and Dingwall 1997). However, these multi-day backcountry visitors represent only a small proportion of the total visitor population to the natural areas managed by the DOC. Visitor numbers and diversity are much higher in the more accessible front-country areas where day use is predominant. Consequently, visitor impact issues such as recreation noise are also more likely to be acute in these areas. This paper identifies some of the main noise impact issues in New Zealand protected natural areas. It reports on an analysis of data from 11 previous surveys of visitors to popular multi-day hiking trails, known as the 'Great Walks' (Cessford 1998a-k). In this context, the types of noise impacts that can occur, the different sources of noise effects and the options available for management are also explored.

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Noise Impact Issues

To enable more effective understanding of the diversity of management issues raised by noise in outdoor recreation, some basic distinctions are helpful. First, it is important to distinguish noise effects from noise impacts. Noise effects are simply the sounds being generated, while noise impacts can be considered as any specifically negative outcomes. However, for practical management purposes, further distinctions are needed to improve answers to the basic impact management questions: What is the problem, who is generating it, and what can we do about it? The most helpful distinctions are between the environmental and social impacts of noise and among the sources generating various noise effects.

Distinguishing Noise Impacts

Environmental and Social Impacts—In protected area management, noise effects are most significant for any disturbance they create for wildlife species. The environmental consequences of these noise effects will on the response-characteristics of the affected species and the degree to which noise variables such as type, volume, periodicity and duration may alter the severity of the effects (National Parks Service 1994; Cessford 1997). In general terms, biological research into noise impacts can focus simply on how the noise affects the behaviour, viability and sustainability of different wildlife species. Contextual factors such as what the noise is, how it is being generated and the primary agents generating it are of little significance in environmental terms. They become more important after impacts issues are identified, and decisions about management actions are required. Yet these types of contextual factors are fundamental to understanding the social consequences of recreational noise. These social impacts do not relate simply to the occurrence of noise events. They are affected much more by the meanings and associations attributed to those noises by the people perceiving some impacts. These subjectively defined social impacts go beyond simple expressions of annoyance. They are commonly related to perceptions of natural quiet, visitor enjoyment and safety concerns (National Park Service 1994).

Natural Quiet—While parks contain many tangible features such as animals, plants, waters, geological features, historic buildings and archaeological sites, they also contain many intangible qualities such as solitude, space, scenery, clear skies, sounds of nature and natural quiet (National Parks Service 1994). Natural quiet does not necessarily mean silence. It can be defined as the natural ambient conditions or the sounds of nature and can range from complete silence to a thunderstorm (Department of

Conservation 1996). Such qualities are considered increasingly significant in providing a counter to the cacophony of everyday life. Extensive U.S. research from the National Park Service (1994) found that over 90% of surveyed visitors considered natural quiet an important part of their reason for visiting a national park. DOC also views natural quiet as a tangible social and environmental value, and it is committed in its Strategic Business Plan (Department of Conservation 1998) to identifying those areas where appropriate restrictions may be required to ensure visitor enjoyment, minimize visitor conflict and protect wildlife. A preliminary process for managers to systematically define areas of natural quiet and locations of noise impact issues is currently underway.

Visitor Enjoyment—Noise effects that intrude on the desired recreation experiences of visitors can have negative impacts on visitor enjoyment. People may still consider their overall recreation experience enjoyable, but the quality of their visit may have been compromised. However, the management task is not simple, as people's reactions to different noise types, levels and contexts are highly variable. Kariel (1980) compared the evaluations of mountaineers and roadside campers for different natural, human and technological noises. Mountaineers were found to be more positively and negatively sensitive to sounds. They rated the nature-related sounds as more pleasant than did the campers, and the human and technology-related sounds as particularly more annoying. While the noise types and levels were the same, the meanings associated with them were not. Sutton (1998) found similar contrasts between different groups of glacier sightseers. Those on the main valley-floor trail indicated much lower aircraft noise annoyance than those on the rugged trails to high valley-wall viewpoints.

In certain cases, the actions of some visitors may generate the noise effects that impact the recreation experiences of others. Most common examples highlight differences between motorized and nonmotorized recreation activities and modes of recreation access. In these cases, motor-noise does more than just disturb natural quiet. The sound of a snowmobile, jet ski, motorbike or helicopter can sometimes be interpreted as a strong indicator of differences in the motivations, goals, environmental values and behaviours of different recreation participants. For example, consistent differences have been identified between the motivations and goals of snowmobilers and cross-country skiers (Knopp and Tyger 1973; Butler 1974; Jackson and Wong 1982). These are not simply cases of one activity versus another, but of how different people value and define their recreation experiences, how they act to achieve these experiences, and how they differ in their perceptions of what are acceptable experience conditions. In this context, the noise effects generally contributing most to noise impact perceptions are from people seeking different recreation goals (Ruddell and Gramman 1994; Gibbons and Ruddell 1995) or from people engaged in obtrusive behaviours (Devall and Harry 1981; Womble and Studebaker 1981; West 1982).

Safety Concerns—One particular association made with noise relates to perceptions of hazard. To a nonmotorized user, the sound of a motorized vehicle can raise a sense of apprehension about possible collisions. Such apprehension can interfere with achievement of recreation experiences. Conversely, for some visitors, sounds indicating the presence of other people and ready access to vehicles can create a sense of reassurance in personally challenging natural settings. The lack of sound from mountain bikes is often perceived as a hazard, due to the surprise encounters that occur. But while some suggest that riders carry bells to reduce the surprise, to others, such noise would be considered intrusive and indicate a wider conflict effect. A similar mix of attitudes can relate to the presence of mobile phones in remote settings, giving reassurance to some visitors and causing disturbance to others.

Distinguishing Noise Sources

While noise impact issues are embedded in wider issues of recreation conflict, clearly establishing the sources of any noise effects remains a particularly important task for managers. If a noise impact issue is revealed or anticipated, the ability to make effective management decisions depends on clearly determining the source of the noise, determining the degree of jurisdiction that can be exercised and identifying the relevant stakeholders for consultation and negotiation. The variety of noise effects that can generate environmental and social impacts can be summarised in four interrelated categories.

External Nonrecreational Noise Intrusions—These can be generated by external sources outside of a conservation manager's control. Perhaps the most intrusive examples worldwide are military aircraft engaging in low-altitude training. Commercial aircraft use flight paths that rarely allow for land use considerations in underlying protected areas, sometimes exacerbating their noise impacts by leaving the additional intrusion of distinctive contrail markings in the sky. Other examples include noise from road, rail and shipping movements, machinery use, industrial processes and general urban noise.

External Recreational Noise Intrusions—External intrusions can also be generated by recreation sources outside management control. Most examples refer to sightseeing aircraft. Other examples include noise from recreational vehicles used on adjacent land areas or waterways managed under different conditions (such as motorbikes, jet skis, and water-skiing). Recreational activities such as large picnic groups or music events may also generate high levels of different noise types. All these types of external noise intrusions could be considered as "edge effects" or "boundary effects."

Onsite Interactivity Noise Intrusions—People sharing settings for different recreation activities under a common management regime can experience inter-activity noise intrusions. These commonly relate to the different types of participants, their behaviours and their use of equipment. The most commonly cited examples highlight differences between motorized and nonmotorized activities (including cross-country skiing versus snowmobiling; canoeing, sailing and swimming versus motorboats, jet skis and water-skiing; skiing versus heli-skiing; walking and cycling versus motorbiking and off-road driving). There are numerous other variations where noise from other nonmotorized activities can contribute to perceptions of intrusion (such as rafting and canoeing versus fishing; walking and running

versus mountain biking; walking versus running; stock-use and dog-walking versus walking). Noise is often the key distinguishing feature between different activities. It can contribute to perception of recreation conflict in two main ways. First by creating a direct sound intrusion that is considered inappropriate by some (such as loud music and mobile phone use). And second by acting as an indicator that an activity or behaviour considered inappropriate is taking place (such as a chainsaw or a motorbike). While these two aspects overlap, it is clear that there is a distinction between the audibility of a noise and the different things that noise can mean to people.

Onsite Intra-Activity Noise Intrusions—People exhibiting different behaviours in the same activity may generate noise intrusions. In principle, the same impact processes apply as with inter-activity noise, but the characteristics are often more subtle. In this situation, people differ in how they participate in the activity and in the meanings they attach to these different behaviours. The social behaviour of some people along trails, at huts and campsites, at picnic areas or at other attractions may not fit with what is considered appropriate by those being impacted. Characteristics of the timing, level and type of noise can play a major role in defining people's perceptions of the appropriateness of different behaviours. Often, these perceptions are accompanied by judgments about the recreation values, motivations and worthiness of those other people in that setting. For example, rowdy behaviour in a hut may be viewed very differently if it is expressed in a different language or accent.

The Great Walks

The collection of trails known as the 'Great Walks' include the most popular and well-known multi-day walking trails in New Zealand. While they are located in wilderness settings, they are specifically managed to make provision for people with an interest in achieving wilderness-related recreation experiences, but who lack sufficient experience, equipment or opportunity to access the more challenging remote areas. These people comprise the DOC visitor-group labelled backcountry-comfort seekers (Department of Conservation 1996, Cessford and Dingwall 1997). To meet the needs of these visitors, the Great Walks are managed to provide high-quality natural settings, highly developed track standards, bridging for all-weather access, regularly located huts providing water, toilet and basic cooking facilities and ready access to main transport routes.

While these Great Walks comprise less than 5% of all the trails managed by the DOC, they are of particular importance, as they help fill the gap between the wilderness user and the front-country user. This gap is between the highly experienced user and the inexperienced user interested in achieving more wilderness-oriented types of recreation experiences. Without the particular opportunity provided by the Great Walks, thousands of people looking for the less demanding overnight hiking experiences in backcountry settings would effectively be excluded from such participation, and the public wilderness constituency would be consequently diminished. Hiker numbers on the Great Walks far exceed those on backcountry trails or in wilderness areas. Moreover, the Great Walks are especially important components of the nature-adventure opportunities commonly associated with New Zealand's tourism industry and image. The numbers of international visitors hiking the Great Walks commonly exceed those of New Zealanders.

As noted internationally (Watson 1995: Manning and others 1996), trends in New Zealand outdoor recreation are characterized by growth in the diversity of visitors and the activities they are engaged in, rather than by simple growth in use levels. Most of this growth is based on steadily increasing international tourist numbers. National exit surveys indicate that each year brings more international visitors participating in increasingly varied activities, much of which is provided by an increasing variety of commercial recreation services (New Zealand Tourism Board 1996). Such growth in the diversity of recreation demand and supply brings with it growth in the diversity of situations where different physical and social impacts may arise. Given the influence of increasing numbers of international visitors in the overall growth of park visitors, and the growing commercial provision of new recreation opportunities, the potential for increased instances of noise impact is also increasing. The Great Walks in New Zealand represent "the front of the backcountry" and, in that respect, offer a strategic location for the investigation of growing social and physical impact issues that may diffuse more widely as overall use levels increase. The remainder of this paper discusses noise impact issues and management, and summarizes the perceptions of noise impacts reported by Great Walk visitors.

Noise Impacts on the Great Walks

A selection of results from an extensive visitor survey based on the Great Walks illustrates the diversity of noise issues. Almost 5 000 visitors were sampled in 11 surveys from several of the most popular multi-day walking trails in New Zealand, a multi-day river-canoeing trip and a multi-day sea-kayaking trip (Cessford 1998a-k). These trips are typically of three to five days' duration in unmodified natural environments of high wilderness quality. Visitors spend the nights in huts or campsites provided by the DOC along the well-defined routes, but they must carry all their own clothing, food and equipment. Generally, visitor expectations on these trips emphasize natural conditions with minimal intrusion by human effects.

Among the questions visitors were asked was the degree to which they experienced different physical and social impacts from various types of human effects, including some related directly to recreational noise. These were:

- hearing aircraft fly overhead/aircraft landing;
- some people being loud in the huts during the evenings;
- some people being loud at campsites in the evenings;
- motorboat disturbance at huts and campsites;
- motorboat disturbance at beaches/on the water.

Visitors were asked, using an awareness/annoyance response scale (fig. 1), to indicate the degree to which they perceived each of these recreational noise effects as impacts on their visit enjoyment. In each case, a proportion of visitors indicated they noticed the noise effect (scores 2-4), and some of these indicated that this bothered them (scores 3+4).

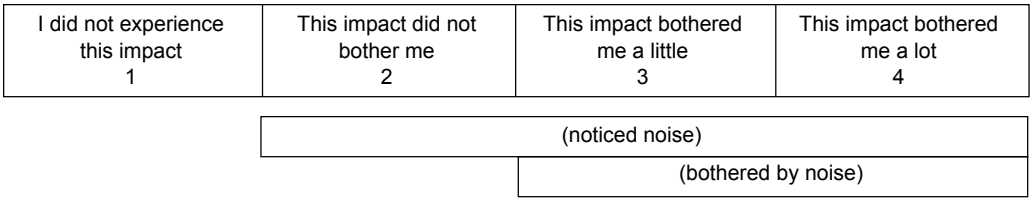

Figure 1—Impact awareness/annoyance response scale.

This approach, when applied across all 11 survey sites, generated evaluations of 38 distinct noise-effect cases, including 11 related to aircraft, 8 related to motorboats, 11 related to social noise in huts and 9 related to social noise at campsites. The 38 cases are listed and ranked in figure 2 according to increasing visitor awareness of the noise effect. This ranking does not directly represent cases of increasing noise levels (volume, duration or event frequency), but shows increasing visitor perception of the noise effects. These ranged from the low perceptions of noisy behaviour at campsites (cases 1-6) through to the very high perceptions of aircraft noise on the Milford track (case 38). In some of these cases, higher awareness levels may reflect greater noise, although this cannot be determined, as measurement of noise-levels was not a required component of the original source surveys. But in other cases, higher awareness may represent greater visitor sensitivity to noise in that visit-experience context.

Overall, the perceptions of noise effects were highly varied across the 38 cases, reflecting their diverse use-types, use-levels, setting characteristics and visitor expectations. The differences between noticing a noise-effect and being bothered by it represent a notable degree of impact tolerance. And this impact tolerance is not consistent. Where the awareness levels are similar, the proportions of visitors actually bothered often varied considerably, suggesting case-specific degrees of noise tolerance. While other research gives some indication that higher noise levels are simply associated with greater perceptions of noise impacts (National Park Service 1994; Sutton 1998), these are not necessarily the primary determining variables in recreational noise management issues. The activity, setting and recreation experience context in which noise effects occur, and the different variables affecting the visitor's individual evaluation of those noise effects, may be more important in most cases. These perceptual variations add great complexity to the manager's task of identifying which noise impact issues are the main priorities for management intervention.

Identifying Noise Impact Issues

A plot of noise awareness versus annoyance (fig. 3) has provided some pragmatic management guidance on noise impact issues by including comparison with U.S. examples, by demonstrating the application of an arbitrary threshold indicator, and by highlighting any particularly exceptional cases with the use of a regression curve.

Comparison With U.S. Examples—The magnitude of some New Zealand noise impact issues is highlighted by comparisons with examples reported in a major review of aircraft noise impacts (National Park Service 1994). Visitor awareness of noise effects exceeded 50% of respondents in 14 of the 38 Great Walk cases (fig. 3), compared with only 5 of 39 U.S. National Park examples (National Park Service 1994). The 91% of aircraft noise awareness on the Milford Track (case 38) far exceeded levels noticed in some major U.S. parks with widely cited aircraft noise problems (Yosemite, 55%; Grand Canyon, 34%). Only the most highly impacted site in the Grand Canyon had noise awareness levels comparable with those on the Milford Track (Hermit Basin, 90%), and while this awareness was similar in both areas, the annoyance level was very much higher on the Milford Track (69% vs 38%). These comparisons suggest that highly significant noise issues do exist in New Zealand's protected areas, and that noise impacts may require more specific management attention.

Specification of an Impact Threshold—The DOC is currently developing a systematic assessment process for managers to identify problem noise situations, and to measure visitor expressions of disturbance. An aircraft noise monitor, based on visitor survey techniques that query aircraft noise awareness and annoyance, has been developed and applied both to aircraft noise issues (Booth 1999) and jetboat noise issues (Graham 1999). Using such measures, an arbitrary 25% threshold level for visitor annoyance with noise has been proposed as a pragmatic management indicator, beyond which some management action is required (Sutton 1998, 1999; Miller 1999). When this threshold is applied to the Great Walks data (fig. 3), nine specific noise impact cases are highlighted (fig. 4). This approach gives managers some initial pragmatic guidance on the more pressing noise management needs. Of note is the prominence of mechanized noise impacts from sources outside of direct management control. The priority need for improving ways to influence external airway and waterway management is also emphasised.

Identifying Exceptional Cases—Another way to guide management attention is to identify noise impact cases that are exceptionally negative. These should include those that cause disproportionately high levels of annoyance. Application of a regression curve to the plot in figure 3 represents one simple means of achieving this. Overall, this shows clearly that as awareness of noise increases, the level of annoyance felt by visitors also increases. The proportion of annoyance among those noticing noise also increases at a faster rate. For example, when 30% of visitors were noticing

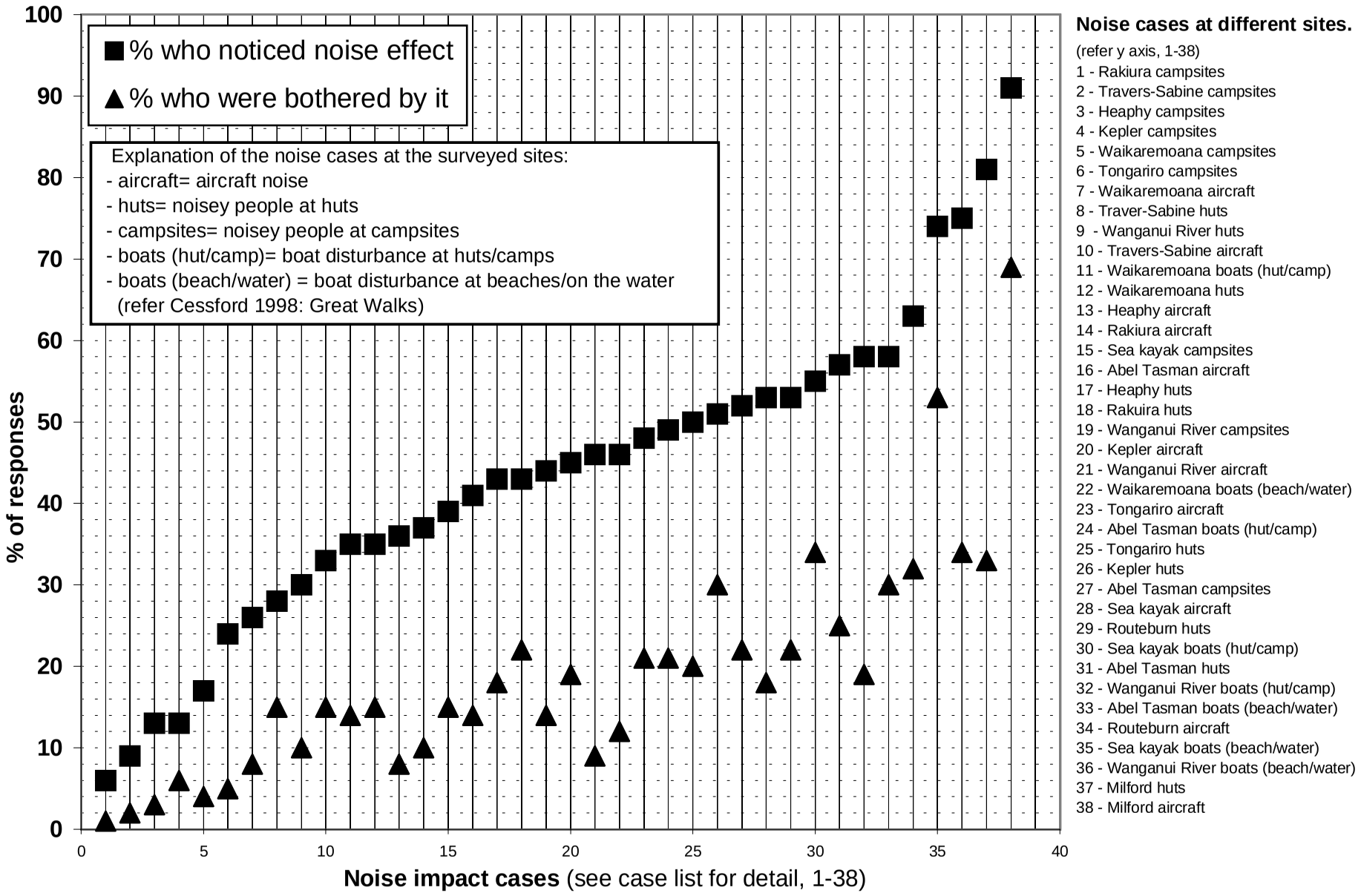

Figure 2—Perceptions of noise effect cases on the Great Walks.

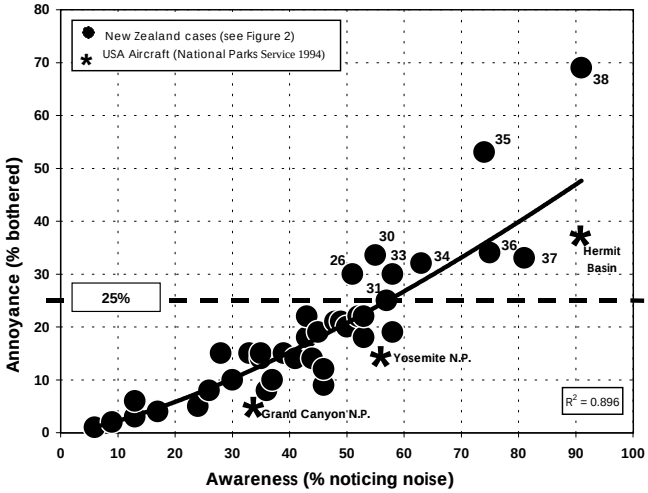

Figure 3—Noise awareness versus noise annoyance.

noise, 10% of the entire sample were also bothered by it. But when 80% were noticing noise, around 40% were bothered. These patterns suggest that the tolerance for noise effects decreases as they become more commonly noticed.

In addition to suggesting an increasing impact trend at higher levels of noise awareness, the curve also highlights the more exceptional annoyance situations. These are the cases plotted exceptionally high above the curve. Management attention should focus first on those cases to determine the cause of the relatively higher annoyance levels and whether they require any management intervention. Such a pragmatic approach can give managers a valuable means to further prioritize their efforts. Applying this approach to the Great Walk results highlights two cases that exceed the 25% annoyance threshold and also appear disproportionately negative (fig. 3). These are the aircraft impacts on walkers of the Milford Track (case 38) and the motorboat impacts on sea-kayakers (case 35). Both of these cases feature mechanized noise impact sources outside direct management control and are in popular settings that are promoted as high-quality natural experiences. And both have projected ongoing use increases. While all nine cases exceeding the 25% threshold may require management attention (fig. 4), this additional refinement indicates which ones may need to be addressed first. The Milford Track emerges as a particular focus for attention, given the very high levels of aircraft noise impact, the international status of this track for both hiking and flightseeing and projections of up to 60% increase in flights over the next 10 years (Hunt 1999).

Noise Management Options

The first problem that managers must deal with, once the need for some management intervention is determined, is the extent of their management jurisdiction. The DOC has most comprehensive control over noise in the management of formally designated wilderness areas. No motorized access or use of motorized equipment is allowed; no tracks, huts or any other facilities can be provided; and the rugged nature of the terrain limits visitor numbers (Cessford and Dingwall 1997). Under these conditions, any recreation noise issues are extremely rare. Conditions of natural quiet are maintained, and largely noise-free recreation experiences are achieved most of the time. However, in all other areas managed by DOC, more complex processes of activity allocation and compromise are required. For example, in national parks, the use of motorized vehicles is limited to official formed roads; aircraft have minimum height and landing limitations; and use of motorized machinery is prohibited. In other areas of higher and more rapidly growing use intensity, such as the front-country or the Great Walks, a greater variety of activities and behaviours may be allowed, creating more potential for noise impact issues.

Case	Site	Issue	Source
38	Milford Track	Aircraft scenic flights bothered 69% of track hikers (91% noticed).	External recreational
35	Abel Tasman Coast	Recreation boats on the water or at beaches bothered 53% of sea-kayakers (74% noticed).	External recreational
36	Wanganui River	Recreation boats on the river bothered 34% of canoeists (75% noticed).	External recreational
30	Abel Tasman Coast	Recreation boats near huts and campsites bothered 33% of sea-kayakers (55% noticed).	External recreational
37	Milford Track	Other people in huts bothered 33% of hikers (81% noticed). Fiordland National Park.	Intra-activity
34	Routeburn Track	Aircraft scenic flights bothered 32% of hikers (63% noticed).	External recreational
33	Abel Tasman Track	Recreation boats on the water or at beaches bothered 30% of hikers (58% noticed).	External recreational
26	Kepler Track	Other people in huts bothered 30% of hikers (51% noticed).	Intra-activity
31	Abel Tasman Track	Other people in huts bothered 25% of walkers (57% noticed).	Intra-activity

Figure 4—Noise impact cases above the 25% threshold.

An important characteristic of most of the prominent noise examples presented in figures 3 and 4 is that many of the noise generating activities come from external sources in settings outside direct management control. Such settings can include overhead and adjacent airspace, navigable waterways, navigable coastlines, adjacent lands and enclave lands. For example, aircraft overflights above 500 metres are subject primarily to Civil Aviation Authority regulations, while motorboat activities on navigable waterways and coastlines beyond mean high water are subject primarily to Ministry of Transport regulations. The options for any direct management control of these aircraft and boat activities are very limited. For any direct controls to be applied in this context, DOC must engage in consultation processes and management partnerships with the appropriate controlling authorities and stakeholder groups.

Noise Management Strategies

Subject to these jurisdictional limits, any park management agency has three broad and interrelated noise-management strategies available.

Managed Separation

Management actions can reduce direct contact between noise generation and reception. These would primarily include actions that separated the visitor activities and behaviours that contributed to the noise impact from those more susceptible to it. This may be achieved most directly through specific allocation of access opportunities to different times or places.

Reduced Noise Effect

Management actions can change the emission and reception characteristics of the noise. These would primarily include direct actions that reduced noise emission levels (mufflers, lower operating levels, developing other options for the task) and indirect actions that reduced the final audibility of the noise effects (insulation, baffles, shielding, masking).

Improved Visitor Expectations

Management actions promoting a more realistic determination of visitor expectations can reduce the relative impact of noise. These actions would primarily include providing information on the prevailing characteristics of activities and noise at different sites and times. This would allow visitors to make more informed choices and expectation compromises. Visitors would be less likely to put themselves in situations where noise would compromise their intended recreation experiences. If they chose to visit a site with known noise conditions, their recreation experience expectations would include compromises to allow for those noise impacts.

When considering the management options available within each of these overall strategies, managers may draw on a range of management approaches. In summary, these include:

- Voluntary agreements: Participating stakeholders agree on codes of practice and standards for activity timing, duration, location, equipment use, operating conditions and behaviours.
- Concession conditions: Management agencies allow commercial recreation activity subject to conditions that specify requirements for activity timing, duration, location, equipment use, operating conditions and behaviours.
- Management regulations: Management agencies allow recreation activity subject to regulations that specify requirements for activity timing, duration, location, equipment use, operating conditions and behaviours.
- Education and advocacy: Management agencies and other stakeholders collaborate to give visitors accurate information about on-site conditions to encourage informed activity and site choices, and to promote appropriate codes of behaviour and noise-sensitive practices.
- Incentives for quiet choices: Management agencies set conditions that favor visitors and commercial providers making quiet-sensitive choices in their equipment types, operating practices, activity timing and location, and behaviour.
- Design for quiet: Management agencies and other stakeholders promote noise-reducing technologies in the design and operation of the equipment used in recreation areas and noise-reducing designs for the layouts, materials and locations of recreation facilities (huts, camps, jetties, airstrips, tracks, roads).

In each case of noise-management need, some integrated combination of these approaches will be required to achieve the best result for the largest number of recreation stakeholders. As recreation activity and diversity continue to increase in protected areas, potential noise impact issues will also increase. Managers will have to consider resource allocation for different activities. Given the finite extent of available lands, any initiative that can allow sustainable use by a variety of activities will be particularly valuable. Subject to wider physical and social impact criteria, ongoing application of a broad range of noise management strategies, as suggested here, can maximize the extent to which activities with different noise signatures can share resources.

Conclusion

The examples provided from the Great Walk surveys suggest that highly significant recreational noise issues exist in New Zealand protected areas. Further, they indicate that priorities for managing these noise impacts should be initially focused on the very site-specific noise effects of scenic aircraft flights, recreational motorboats and congestion in busy huts. For addressing the aircraft and motorboat noise issues, particular emphasis is required on developing cooperative approaches with external airway and waterway management agencies, regulatory authorities and commercial recreation providers. For addressing the hut noise behavioral issues, more conclusive social research and information are required to determine what activity conditions and behaviours lead to the social noise problems in some huts.

These recreational noise impacts appear to be quite severe and, in some cases may compromise the degree to which

visitors can achieve quality recreation experiences. However, while some noise impact issues were very prominent in many of the Great Walk examples, they may be no more than indicators of wider recreation conflict issues in some cases. The diversity in visitor tolerance for similar levels of noise effects suggests that many other intervening factors affect the final negative perceptions of noise impacts. In either situation, the management challenge is still to determine how these interrelated noise effects and underlying conflict issues can be managed and reduced, without also seriously compromising the viability of the activities that generate them. Overall, the distinction between the disturbance by noise effects and the wider, underlying recreation conflict issues requires more investigation. If noise is not the main contributing factor to such conflict issues, it is clearly one of the more prominent indicators. In this respect, noise will be a key component of many social conflict issues. Initiatives that generally promote reduction of noise effects should clearly have high priority in any social impact management programs. Finding better ways for different visitors to successfully share sites will be an increasingly valuable outcome, particularly in settings subject to pressures from increasing visitor numbers and diversity, such as those represented by the Great Walks.

Investigation of noise impacts should also expand to cover more of the low-use protected areas. In these areas, visitor expectations of remoteness and wilderness may contribute to higher noise annoyance at much lower levels of noise generation. Overall, to maximize the contribution made to management processes, any future research directed specifically at noise impact issues should integrate consideration of visitor awareness and annoyance levels, visitor expectations of the recreation experiences in the chosen study area, and some consistent measure of actual noise-level variables.

Acknowledgment

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Leave No Trace Practices: Behaviors and Preferences of Wilderness Visitors Regarding Use of Cookstoves and Camping Away From Lakes

Neal A. Christensen
David N. Cole

Abstract—This research used descriptive information collected in visitor studies conducted between 1990 and 1992 in eight different wildernesses around the United States to evaluate behaviors and preferences of wilderness visitors regarding cookstoves and camping away from lakes. The majority of visitors used stoves for cooking. However, in all but the Desolation Wilderness, at least 50% of visitors had a wood fire on their trip. In all five areas, most visitors prefer camping within 200 feet of a lake. Appeals were successful in convincing over half of the campers to move farther away from lakeshores. Ecological appeals were more persuasive than social appeals. Progress has been made in persuading visitors to reduce fire use and camp farther from lakes.

Wilderness managers are challenged by the need to control the social and ecological impacts of recreation use while minimizing restrictions on access and behavior in wilderness. Visitor education is a preferred management technique because it does not restrict access or freedom. The primary objections to relying too much on education are its effectiveness, its timeliness (how long will it take for education to work?) and whether costs are distributed equitably. When behaviors are recommended rather than required, conscientious users absorb all the costs (in terms of giving up preferred activities, such as having a fire), while unconscientious visitors do not.

Although there is controversy about the extent to which education should be considered an appropriate response to specific existing management problems (Cole 1995), most people agree that education is a worthwhile preventive action that should be universally applied. Over the past few decades, numerous idiosyncratic programs have been developed that attempted to teach visitors low-impact practices. Recently, these efforts have culminated in the coordinated Leave No Trace program, an effort promoted by all management agencies, as well as private nongovernmental organizations and for-profit corporations.

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The Leave No Trace program—and other educational programs—advance many recommended behaviors that, if followed, will clearly reduce impacts (Hampton and Cole 1995). Perhaps the original and best-known practice is the "pack-it-in, pack-it-out" anti-littering message. Evidence suggests that litter is much less a problem in wilderness than it was a few decades ago (Cole and others 1995). This is at least partially a result of this educational campaign (Roggenbuck 1992).

Two other practices that have been promoted for decades are (1) to use cookstoves for cooking and minimize the use of wood fires and (2) to camp away (usually at least 200 feet) from lakeshores. The rationales behind these recommendations are that (1) impacts from collecting and burning wood would be reduced if all visitors cooked on gas stoves and minimized the use of wood fires for enjoyment and (2) the potential for ecological and social impacts would be reduced if visitors camped away from lakeshores. Less likelihood of water pollution and soil and vegetation impact can potentially justify camping away from lakeshores. However, there are reasons to expect that proximity to lakeshores is poorly correlated with impact potential, particularly soil and vegetation damage (Cole 1981). Social justifications for camping farther from lakeshores are that if you camp away from a lake (1) fewer people would walk through your camp, (2) you would see fewer people, and (3) you would see fewer lakeshore camps. Despite the prevalence of these recommendations, we have little understanding of compliance with them or of the effectiveness of persuasive arguments intended to increase compliance.

The data source used in this paper is a number of wilderness visitor surveys from around the United States, collected for other purposes, that asked questions regarding use of stoves/wood fires and camping close to lakeshores. This paper presents descriptive information collected in visitor studies from eight different wildernesses regarding (1) use of and preferences for stoves and wood fires, (2) opinions about restrictions on wood fires, (3) preferred camping distances from lakeshores and (4) the likely persuasiveness of various social or ecological reasons to camp farther than preferred from a lakeshore. The unusual opportunity to look for consistency across as many as eight wildernesses allowed us to assess how well findings could be generalized. This information should give managers insight into how prevalent preferred behavior is and the persuasiveness of alternative messages.

In addition, we assessed the extent to which various visitor characteristics (trip attributes, sociodemographic characteristics, motivations, evaluations and management preferences) explain variation in behavior and persuasiveness. Specifically, we assessed the influence of visitor characteristics on (1) whether groups had any wood fires for enjoyment on their trip, (2) whether they thought they could be persuaded to camp farther than preferred from lakeshores by any of three social reasons and (3) whether they thought they could be persuaded to camp farther than preferred from lakeshores by either of two ecological reasons. If any visitor characteristics are strongly related to either behavior or persuasiveness of different messages, managers can use this information to target certain noncompliant visitors and to focus on the most persuasive messages.

Theory suggests that visitor characteristics are one of a number of attributes that should influence both behavior and persuasibility (Ajzen 1992, Manning 1985). We would expect that groups on long trips would be more likely to have at least one wood enjoyment fire simply because they have more opportunities to do so. Of more interest, we expect groups that had wood enjoyment fires to be larger because fires contribute to socializing. We expect that less experienced visitors would also be more likely to have wood fires because they might be less knowledgeable about and/or committed to avoiding the impacts associated with fires. Groups that are less motivated to be alone and are less sensitive to crowding and ecological impacts, particularly those associated with fire, should be more likely to have wood fires.

We expect that groups reporting they could be persuaded by social reasons to camp farther than preferred from lakeshores would tend to be more experienced in wilderness travel. We expect them to be more frequently motivated to be alone and more sensitive to social impacts. They also should be more accepting of rules and regulations. We would expect groups persuaded by ecological reasons to be more experienced in wilderness travel. We expect them to be more sensitive to ecological impacts and to be more accepting of rules and regulations. In general, we expect experienced visitors to be more easily persuaded (by either social or ecological reasons) than less experienced visitors.

Study Areas and Methods

Eight separate wilderness visitor surveys, conducted between 1990 and 1992, were used in this study. However, only a few variables were evaluated for some of these wildernesses. One wilderness has no lakes and another has designated campsites, so questions regarding lakeshore setbacks make no sense. Another wilderness instituted a campfire prohibition the year of the survey, so results must be tempered by this regulation. We combined two different but adjacent wildernesses, John Muir and Sequoia-Kings Canyon, because many visitors used both wildernesses on the same trip.

Boundary Waters Canoe Area Wilderness

This wilderness, in northern Minnesota, is the second largest wilderness east of the Rocky Mountains (1,086,000 acres) and the most-used wilderness in the system (about 1.5 million recreation visitor-days per year). Most travel is by canoe, with overnighters camping at one of over 2,000 designated campsites, each with a fireplace and a toilet. Entry permits are required, limited and sometimes difficult to obtain. Between mid-May and early September 1991, a sample of overnight visitors was obtained as visitors exited from 14 moderate- and heavy-use and 25 light-use trailheads that account for 80% of the use in the area. The number of usable surveys was 215 from the moderate- and heavy-use trailheads and 80 from the light use trailheads. Responses of low-use trailhead entrants were weighted, so the proportion of responses from each trailhead reflected the proportional distribution of permits across trailheads. Both group leaders and members were included in the sample. This sample should adequately represent overnight visitors during the main use season, particularly those exiting from popular trailheads. Only a few of the questions related to fire and stove use were asked here; no questions related to lakeshore setbacks were asked because camping was restricted to designated sites.

Shining Rock Wilderness

The Shining Rock Wilderness, in western North Carolina, is of moderate size for an Eastern wilderness (18,500 acres). It is also quite heavily used on a per-acre basis (three recreation visitor-days per acre per year). There are no lakes in the wilderness to serve as destination areas. Most trails in the wilderness converge at a half-acre grassy bald, Shining Rock Gap, where about one-third of all camping occurs. Permits are not required, and there are few restrictions on behavior. In 1990, a representative sample of all main-use-season visitors over the age of 15—both day and overnight, both group leaders and members—was obtained during randomly selected time blocks at eight trail entry points. This sample produced 439 usable mail-back surveys. Questions were limited to those associated with use of stoves and wood fires.

Desolation Wilderness

The Desolation Wilderness, in the central Sierra Nevada in California, is of moderate size for a Western wilderness (63,475 acres). Located close to Lake Tahoe, with about 130 scenic lakes, it is heavily used on a per-acre basis (about five recreation visitor days per acre per year). Entry permits have been required for close to 30 years. A prohibition on campfires was implemented in 1990, the year visitors were sampled. Both fire use and lakeshore setback data are presented, but the fire data suggest behavior that would have been very different the year before and probably is different today, when the prohibition is more established. The survey sample was obtained from permit-holders, both day and overnight visitors. Although a small sample of party members was obtained (81 useable surveys), party members were underweighted compared with the 438 surveys from permit-holders. Groups that did not obtain a permit were also not included, but a sample of 118 noncompliers did not differ from compliers on any of the questions reported in this paper.

Mount Jefferson Wilderness

The Mount Jefferson Wilderness, in the central Cascade Mountains of Oregon, is larger than most wildernesses (107,000 acres). Located close to the heavily populated Willamette Valley, with many scenic lakes, it is among the more heavily used wildernesses in Oregon. Permits were required of all visitors beginning in 1991, the year the visitor survey was conducted. Campfires are generally permitted, but not within 150 feet of water or trails around certain popular lakes. A sample of day and overnight permit-holders was obtained in 1991. The full spectrum from low-use to high-use trailheads was included, with the total number of usable surveys approaching 600.

Mount Washington Wilderness

The Mount Washington Wilderness, in the central Cascade Mountains of Oregon, is of moderate size (52,000 acres). Located just south of the Mount Jefferson, close to the heavily populated Willamette Valley, with a number of scenic lakes, it is less heavily used than many other wildernesses in the Oregon Cascades. Permits were required of all visitors beginning in 1991, the year the visitor survey was conducted. A sample of day and overnight permit-holders was obtained in 1991. The full spectrum from low-use to high-use trailheads was included, with the total number of usable surveys exceeding 200.

Three Sisters Wilderness

The Three Sisters Wilderness, in the central Cascade Mountains of Oregon, is larger than most wildernesses (287,000 acres). Located just south of the Mount Washington Wilderness, close to the heavily populated Willamette Valley, with many scenic lakes, it is among the more heavily used wildernesses in Oregon. Permits were required of all visitors beginning in 1991, the year the visitor survey was conducted. Campfires are generally permitted, but not within one-quarter to one-half mile of certain trails and/or lakes. Camping is not permitted within 100 feet of water or trails, at least in portions of the Wilderness. A sample of day and overnight permit-holders was obtained in 1991. The full spectrum from low-use to high-use trailheads was included, with the total number of usable surveys exceeding 600.

John Muir and Sequoia-Kings Canyon Wildernesses

The John Muir Wilderness, managed by the Forest Service, and Sequoia-Kings Canyon Wilderness, managed by the National Park Service, are contiguous large wildernesses in the south-central Sierra Nevada of California. Together, they exceed 1.3 million acres. Located within a half-day drive of major metropolitan areas in California and containing hundreds of scenic lakes, each of these wildernesses is among the 10 most frequently visited wildernesses in the system, with a combined annual visitation of over one million recreation visitor-days. Permits, limited in number, have been required for close to 30 years. In addition, campfires have been prohibited above specified elevations, where wood productivity is limited. Both wildernesses were separately sampled in 1990, using similar methods and questionnaires. When it became apparent that many visitors sampled when entering the John Muir spent most of their time in the Sequoia-Kings Canyon and the opposite was true as well, we decided to combine the two sets of surveys. Names of permit-holders were sampled from permits. Names of group members were obtained from permit holders. Eventually, we collected 515 usable surveys from the John Muir and 390 usable surveys from Sequoia-Kings Canyon. In both cases, about 75% of the surveys came from permit-holders.

Data Analysis

Much of the analysis was simply descriptive statistics. Our analysis of visitor characteristics related to (1) having an enjoyment fire or not and (2) whether social or ecological reasons could persuade visitors to camp farther than preferred from lakes was more complex. For one thing we used only the John Muir/Sequoia-Kings Canyon data set and a second data set produced by combining the three wildernesses close together in the Oregon Cascades. For each of these two data sets, we initially examined bivariate relationships between these variables and a wide variety of visitor characteristics, particularly those for which we had developed expectations. Chi-square, Somer's d, and t-tests were used to search for significant bivariate relationships, depending on whether visitor characteristics were assessed as nominal, ordinal or interval level data, respectively. Variables that differed significantly were then entered into a multivariate logistic regression, using a backward stepwise algorithm, to identify variables that remained statistically explanatory in a multivariate context and to assess the predictive value of a multivariate model.

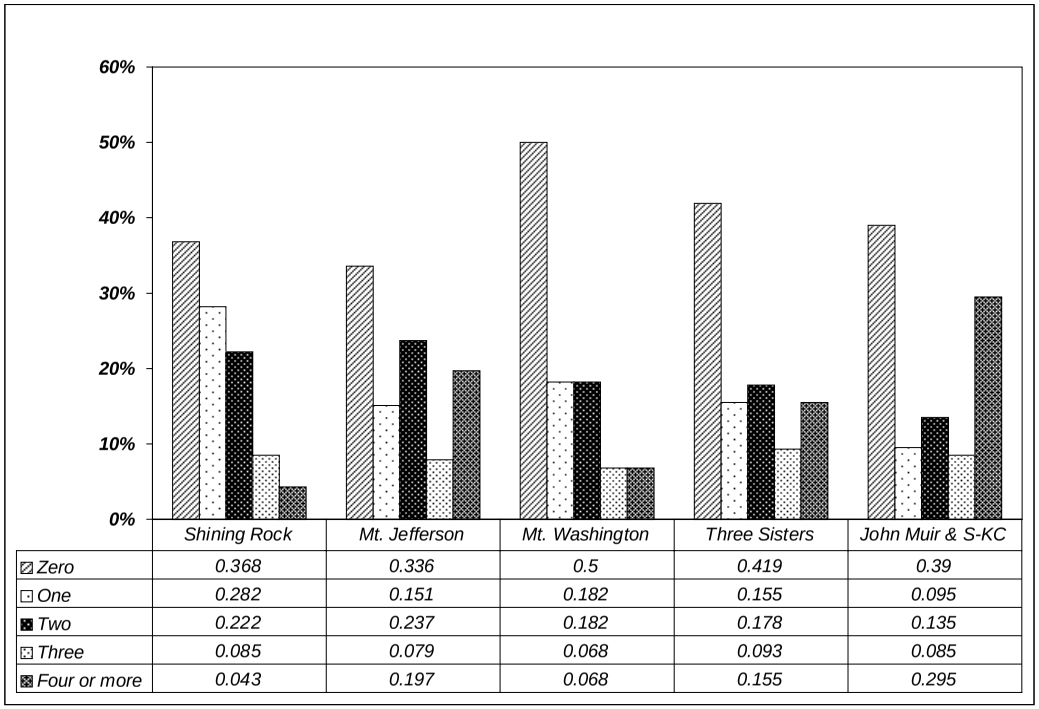
Use of Cookstoves and Wood Fires Results

The use of cookstoves and fires was assessed in the Boundary Waters Canoe Area, the Desolation, Mount Jefferson, Mount Washington, Three Sisters, Shining Rock and John Muir/Sequoia - Kings Canyon Wildernesses. The majority of people in all areas reported using (and preferring to use) stoves for cooking (table 1). Cookstove use ranged from 65% in the Boundary Waters to 95% in the Desolation (where campfires are prohibited). However, in all but the Desolation, at least 50% of people had at least one wood fire on their trip (fig. 1). Mount Washington respondents exhibited the lowest fire use, with 50% having no campfires. John Muir and Sequoia - Kings Canyon respondents reported the greatest use of campfires, with 30% indicating they had four or more on their trip. The number of campfires per trip generally increased with size of the areas, with smaller areas like Shining Rock and Mount Washington having fewer and the largest area, John Muir and Sequoia - Kings Canyon, having the most per trip. About half of all respondents, not including those in the Desolation, had campfires for enjoyment only (ranging from 41% at Mount Jefferson to 60% at Boundary Waters and Shining Rock). The proportion of respondents with enjoyment fires was highest in the two Eastern areas - the Boundary Waters and Shining Rock. It

Table 1—Campfire and cookstove use and evaluation of fire-related problems in wilderness.

	Boundary Waters Canoe Area (1991) n = 285	Desolation [a] (1990) n = 229	Mt. Jefferson (1991) n = 157	Mt. Washington (1991) n = 46	Three Sisters (1991) n = 141	Shining Rock (1990) n = 236	John Muir & Sequoia - Kings Canyon (1990) n = 866
Behaviors:							
Did you use a stove for cooking on this trip? (% Yes)	65%	95%	79%	78%	79%	84%	67%
Do you prefer using a stove for cooking? (% Yes)		82%	70%	87%	76%	78%	
Did you have a wood fire any time on this trip (% Yes)		17%	65%	50%	58%	63%	61%
Did you have a wood fire for enjoyment only (% Yes)	60%	18%	41%	43%	44%	60%	45%
Problem Evaluations:							
Not enough firewood (% indicating a problem)	25%		30%	15%	13%		16%
Fire rings too built up (% indicating a problem)		36%				26%	
Too many fire rings (% indicating a problem)		41%	30%	21%	23%	28%	
Fire rings full of trash , ashes (% indicating a problem)		37%	39%	33%	26%	30%	

[a]1992 was the first year that campfires were prohibited in the Desolation Wilderness.



	Shining Rock	Mt. Jefferson	Mt. Washington	Three Sisters	John Muir & S-KC
Zero	0.368	0.336	0.5	0.419	0.39
One	0.282	0.151	0.182	0.155	0.095
Two	0.222	0.237	0.182	0.178	0.135
Three	0.085	0.079	0.068	0.093	0.085
Four or more	0.043	0.197	0.068	0.155	0.295

Figure 1—Number of campfires on this wilderness trip.

is interesting to note that 18% of Desolation respondents had enjoyment fires despite their prohibition.

Desolation Wilderness respondents generally reported the highest levels of problems associated with the use of campfires (table 1). While campfires were prohibited in the Desolation during the time of the study, the restriction was newly implemented, and many of the impacts from past fire use apparently remained. Forty-one percent of the Desolation respondents reported problems with too many fire rings, while 37% saw problems with fire rings full of trash and ashes, and 36% felt that fire rings were too built up. These larger numbers may reflect a judgment of the inappropriateness of fires given the fire prohibition. Mount Jefferson Wilderness respondents also reported relatively high problem levels, with 30% reporting a shortage of firewood, 39% seeing problems with fire rings full of trash and ashes and 30% feeling that there were too many fire rings.

To better understand the influence of visitor characteristics on campfire behaviors, we compared respondents who used wood fires for enjoyment with those who did not. The data sets used were the combined John Muir and Sequoia - Kings Canyon Wildernesses in California and the combined Mount Jefferson, Mount Washington and Three Sisters Wildernesses in Oregon. Visitors who had at least one campfire for enjoyment differed from those who had none in a number of ways. Significant relationships were as follows:

In the Mount Jefferson, Mount Washington and Three Sisters Wildernesses respondents who had enjoyment fires were more likely to:

- be in larger groups
- be horse users
- not be traveling alone
- have less educational attainment
- feel that a high number of groups walking past their camp was all right
- feel less crowded
- feel they had few problems with finding a suitable campsite
- feel they had few problems with too many fire rings
- feel they had few problems with privacy in camp
- feel they had few problems with campsite vegetation destruction
- feel that vegetation loss in campsites did not detract from their experience
- feel that litter detracted a lot from their experience
- not favor prohibiting camping at overused sites

In the John Muir and Sequoia - Kings Canyon Wildernesses, respondents who had enjoyment fires were more likely to:

- stay longer
- have made fewer visits to any wilderness in the past 12 months
- be horse users
- fish
- typically take long wilderness trips
- feel they had fewer problems with too many people
- not agree with the idea that wilderness should be a place to be alone
- not agree that the area is a place with too many people
- agree that they enjoyed sharing the experience with companions
- agree that spending time with companions was a trip focal point
- agree that their attention was focused on outdoor activities
- feel they had few problems with vegetation damage caused by horses

A logistic regression model was constructed for each of the two study areas. The model used the set of significant variables found in the bivariate analyses as predictors of whether respondents had campfires for enjoyment during their wilderness trips.

In the model constructed for the Oregon areas, three of the 13 bivariately significant variables remained significant in the multivariate model. Group size, number of groups walking past camp that is all right and level of agreement that vegetation loss detracted from the experience all remained significant in the regression model. The Nagelkerke R^2 for the Oregon model was just 0.31, and the improvement over chance in classification ability was just 13%.

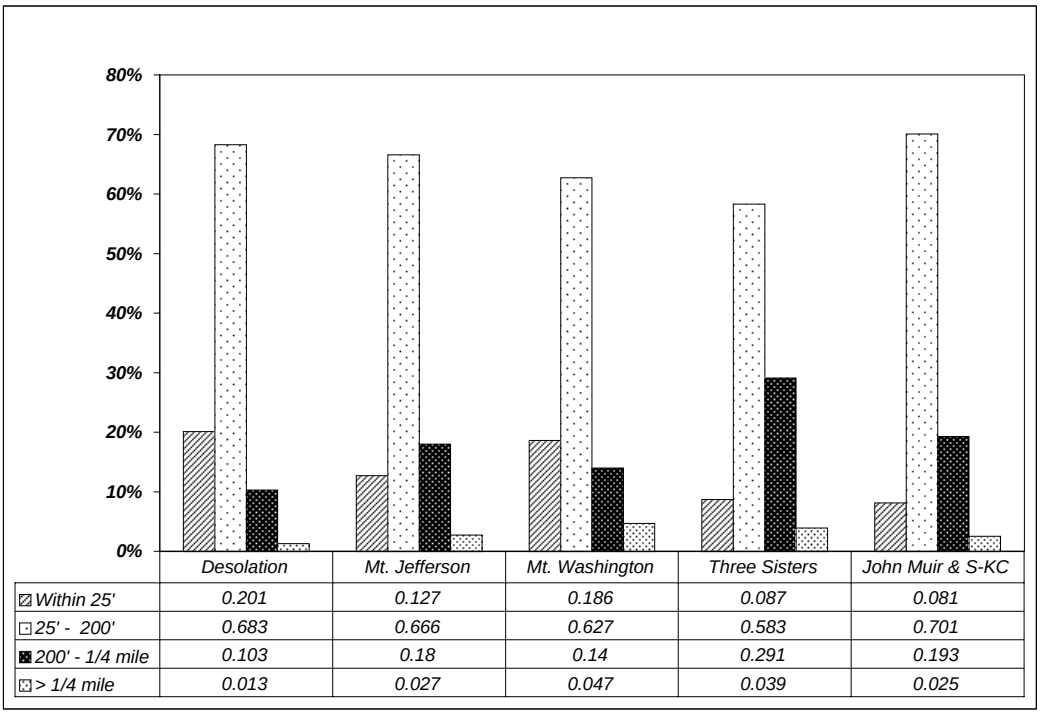
In the model based on the California areas sample, three of the original 12 variables remained significant. Length of stay, whether or not the group backpacked, and level of agreement that the wilderness is a place to be alone were significant predictors of enjoyment fire. The Nagelkerke R^2 for the California model was just 0.10, and the improvement in predictability was just 10%.

These results suggest that a number of visitor characteristics are associated with the likelihood of having a wood fire for enjoyment. As expected, larger groups and groups on long trips were more likely to have fires, as were less experienced users and users who did not feel strongly about being alone or were less sensitive to social and ecological impacts. Unexpectedly, groups with fires were more likely to travel on horseback, fish, be less educated and more sensitive to litter. None of the relationships is particularly strong, however, suggesting very little ability to predict campfire behavior on the basis of visitor characteristics.

Lakeshore Camping Setbacks

Respondents in the Desolation, Mount Jefferson, Mount Washington, Three Sisters and the combined John Muir and Sequoia - Kings Canyon Wildernesses were asked about their preferences for camping close to lakes and their willingness to move their campsite location farther from a lake than preferred. Most commonly, 200 feet is the recommended setback from lakes (Cole 1989). In all five areas, most visitors prefer camping within 200 feet of a lake (fig. 2). The Desolation and Mount Washington areas had the greatest percentage of respondents preferring to camp within 200 feet of a lake - 88% and 82% respectively. The Three Sisters Wilderness had the greatest percentage of respondents (33%) preferring to camp more than 200 feet from a lakeshore. The percent preferring to camp more than one quarter mile from lakes was greatest in those wildernesses with the fewest lakes.

Respondents in these study areas were also asked if they would voluntarily camp farther away from the lake than they preferred if it would result in reduced impacts - either sociological or ecological. Five questions were asked, two listing resource protection outcomes (less soil and vegetation impact and less water pollution) and three resulting in



	Desolation	Mt. Jefferson	Mt. Washington	Three Sisters	John Muir & S-KC
Within 25'	0.201	0.127	0.186	0.087	0.081
25' - 200'	0.683	0.666	0.627	0.583	0.701
200' - 1/4 mile	0.103	0.18	0.14	0.291	0.193
> 1/4 mile	0.013	0.027	0.047	0.039	0.025

Figure 2—Preferred camping distance from a lake.

reduced encounters of various kinds with other people (see fewer people, fewer people through camp, and not see other lakeshore campsites). This analysis was limited to only those people who preferred to camp within 200 feet of a lakeshore.

All of the appeals were successful in convincing over half of the campers who prefer a lakeside location to indicate that they would move farther away (table 2). Having fewer people walk through your camp was slightly more persuasive than other social arguments and reducing water pollution was more persuasive than reducing soil and vegetation impacts. The two ecological appeals were somewhat more persuasive than the three social appeals. The percentage of respondents that could not be convinced by any of the appeals ranged from 6% at John Muir and Sequoia - Kings Canyon to 18% at the Three Sisters Wilderness. A very small percentage of respondents (1%-4%) indicated that they would be convinced only by the sociological appeals, while a substantial minority (20%-30%) were persuaded only by ecological reasons. This is an interesting finding, given arguments that

Table 2—Self-reported effectiveness of alternative appeals to get visitors to camp farther than preferred from lakes. [a]

	Desolation (1990) n = 229	Mt. Jefferson (1991) n = 157	Mt. Washington (1991) n = 46	Three Sisters (1991) n = 141	John Muir & Sequoia - Kings Canyon (1990) n = 866
% willing to volunteer to camp farther away from a lake than preferred:					
if you would see fewer people	59%	57%	74%	55%	56%
if fewer people would walk through camp	59%	60%	67%	57%	61%
if you wouldn't see other lakeshore camps	51%	54%	65%	54%	53%
if it would cause less soil and veg impact	80%	75%	83%	72%	82%
if would mean less water pollution	86%	78%	80%	78%	88%
% of people for whom:					
no reasons are persuasive	9%	17%	9%	18%	6%
only sociological reasons are persuasive	4%	3%	4%	1%	3%
only ecological reasons are persuasive	20%	26%	22%	30%	22%
both types of reasons are persuasive	67%	54%	65%	51%	69%

[a]Confined to those who preferred to camp < 200 feet from lakes.

ecological reasons may be more difficult to substantiate than social reasons (Cole 1981). Both types of appeals would persuade the majority of respondents (51%-69%).

To further understand the influence of visitor characteristics on the persuasibility of respondents who preferred to camp within 200 feet of the lake, we compared those who reported they could be persuaded with those who reported they could not. These analyses were limited to two data sets – the combined Oregon samples of Mount Jefferson, Mount Washington, and Three Sisters and the combined California samples of John Muir and Sequoia-Kings Canyon. Analyses were conducted on (1) whether the respondent could be persuaded to change their behavior based on ecological appeals, and (2) whether or not the respondent could be persuaded by sociological appeals. Bivariate relationships were evaluated using either t-tests, Pearsons Chi-square or Somer's d statistics, as appropriate for the level of measurement.

At Mount Jefferson, Mount Washington and Three Sisters, visitors who preferred to camp within 200 feet of a lake, but would volunteer to camp farther away based on appeals regarding social impacts, were more likely to:

- have recently visited this wilderness for the first time
- have made fewer total visits to this area
- be backpackers
- not fish
- have seen greater number of hikers than expected
- feel crowded
- feel there were problems with privacy in camp
- feel there were problems with too many fire rings
- feel there were problems with campsite vegetation destruction
- feel that vegetation loss in campsites detracted from their experience
- feel they had few problems with too many rules
- favor prohibiting the use of over-used campsites
- favor camping in designated sites only
- favor closing over-used campsites

At John Muir and Sequoia - Kings Canyon, visitors who would volunteer to camp farther from lakes based on social impact appeals were more likely to:

- have seen more groups passing their camp
- feel there were problems with too many people
- agree to limiting party size
- feel that this wilderness should be a place to be alone
- agree that this wilderness is a place with too many people
- feel there were problems with litter
- notice physical impacts from inappropriate behavior
- feel there were problems with horse damage to vegetation
- agree that this wilderness should be a place with strict visitor regulations
- agree that this wilderness is a place without enough regulations
- agree that this wilderness is a place to test their skills
- disagree with the statement 'I get more satisfaction out of visiting this place than from visiting any other recreation place.'
- disagree with the statement 'I wouldn't substitute any other area for doing the type of things I did here.'

At Mount Jefferson, Mount Washington and Three Sisters, visitors who preferred to camp within 200 feet of a lake, but would volunteer to camp farther away based on ecological impact appeals, were more likely to:

- be young
- have recently visited this wilderness for the first time
- have visited a large number of other wildernesses
- have visited this wilderness fewer times
- be backpackers
- not fish
- not have talked to a ranger
- feel that vegetation loss in campsites detracted from their experience
- feel that tree damage by people detracted from their experience
- feel there were problems with too many fire rings
- favor prohibiting use of over-used sites
- favor closing over-used sites

At John Muir and Sequoia - Kings Canyon, visitors who would volunteer to camp farther from lakes based on ecological impact appeals were more likely to:

- have visited this wilderness fewer times
- favor limiting party size
- agree that this wilderness is a place with too many people
- feel there were problems with too many people
- feel there were problems with litter
- notice physical impacts from inappropriate behavior
- feel there were problems with human-caused damage to vegetation
- agree that this wilderness should be a place with strict visitor regulations
- agree that this wilderness is a place without enough regulations
- disagree that this wilderness is a place with too many regulations
- agree that this wilderness is a place to test their skills

Multivariate modeling was conducted using variables found to be statistically significant in the bivariate analyses. Four logistic regression models, utilizing backward stepwise algorithms, were constructed - one for each of the two combined study areas and each of the two types of appeals. If successful, these models could be used to predict willingness to modify camping behavior based on a particular type of appeal - social or ecological.

In the model constructed for the Oregon areas, assessing willingness to modify behavior based on sociological appeals, just two of the 14 bivariately significant variables remained significant in the multivariate model. Whether the respondents felt there were too many regulations and whether they backpacked remained significantly related to their willingness to camp farther away based on sociological concerns. The Nagelkerke R^2 for the model was just 0.19, and the improvement over chance in classification ability was just 9%.

In the California area model for the sociological appeals, three of the original 13 significant variables remained significant in the multivariate logistic regression. The three variables were: whether they noticed physical impacts from inappropriate behavior, the level of agreement with the

statement "I wouldn't substitute any other area for doing the type of things I did here," and agreeing that "this wilderness should be a place to be alone." The Nagelkerke R^2 was 0.30, and the improvement in classification was 1%.

The model for the combined Mount Jefferson, Mount Washington and Three Sisters Wildernesses based on ecological appeals had a Nagelkerke R^2 of 0.62, but the improvement in classification ability was just 1%. Three variables of the original 12 remained significant in the regression model. These variables were: whether the respondent fished, whether they felt that vegetation loss detracted from their experience and whether they talked to a ranger.

The ecological appeals in the model for the John Muir and Sequoia - Kings Canyon Wildernesses had a Nagelkerke R^2 of 0.73, but the model did not increase classification ability beyond that achieved by chance. The three variables of the original 11 that remained significant in the model were: whether they felt there were problems with too many people, whether they supported limiting party size and their agreement with the statement that "this wilderness is a place without enough regulations."

These results suggest that many visitor characteristics are related to the likelihood that a camper could be persuaded to camp farther from a lake than preferred. As expected, those who could be persuaded by social appeals were more motivated to be alone, more sensitive to social impacts and more accepting of rules and regulations. Unexpectedly, general wilderness experience was not related to persuasibility, and local experience was inversely related to persuasibility. In addition, horse users, fishers and visitors with a high degree of place attachment were less readily persuaded. As expected, those who could be persuaded by ecological reasons were more generally experienced in wilderness travel, more sensitive to ecological impacts and more accepting of rules and regulations. As was the case with social appeals, local experience, horse use and fishing were all inversely related to persuasibility, and sensitivity to social impacts was positively related to persuasibility. None of these relationships are very strong, however, suggesting very little ability to predict the persuasibility of different visitor types.

It is interesting to note that general wilderness experience is positively related to persuasibility of only ecological appeals and that local experience is negatively related to both types of appeals. The finding that talking to a ranger was inversely related to persuasibility was a surprise. This could mean that talking to a ranger caused visitors to become less readily persuaded, but we doubt this. It is more likely that visitors who are not readily persuaded are more likely to talk to a ranger, either because they camp in places closer to where other people walk and are more gregarious – both of these reasons are supported by data – or because they are behaving in ways that cause a ranger to talk to them.

Discussion and Implications

These data suggest that low-impact messages about using stoves, minimizing fires, and camping away from lakes have had an effect. Thirty to 40 years ago, virtually everyone had a campfire every night and, when camped at a lake, camped within 100 feet of it; few carried gas stoves. Today, most groups bring a stove with them, and most prefer cooking on the stove to cooking over a wood fire. This is an impressive change. The reduction in fire use is less impressive. In all areas we surveyed, where campfires are allowed, at least 50 percent of groups had at least one fire on their trip. This continued use of fire may not be surprising, given our finding that only one-quarter to one-half of visitors felt that there were any problems with lack of firewood, too many fire rings or built-up and trashy fire rings. Reductions in fire frequency are more dramatic, however. In the two areas where we had length-of-stay data, the percentage of nights visitors had fires was 18% in Shining Rock Wilderness and 63% in the John Muir/Sequoia-Kings Canyon Wildernesses. This suggests a reduction in fire use of 50 to 90 percent, assuming that two fires a day is no longer the norm. At Shining Rock, virtually all fires were enjoyment fires. At John Muir/ Sequoia-Kings Canyon, cooking fires were more common, so only about 75 percent of fires were enjoyment fires only.

It is also worth noting that although fires were prohibited at Desolation, 18 percent admitted to having at least one fire on their trip. This level of illegal behavior might be explained by the fact that this was the first year of the prohibition. It is also worth noting that at Desolation, although 78 percent supported a campfire prohibition where firewood was scarce and 75 percent supported the notion of not allowing new fire rings, only 37 percent supported a total ban on campfires.

If visitors camp where they prefer, progress in getting people to camp away from lakes is even less pronounced. Typically, only about 20 percent of visitors prefer to camp more than 200 feet from a lake. The good news, however, is that over 80 percent of visitors who prefer camping close to lakes report that they could be persuaded to camp farther back than they prefer. Ecological reasons are more compelling persuasive arguments than social reasons. Twenty to 30 percent of visitors who could be persuaded by an ecological reason to camp away from lakes would not be convinced by a social reason. Virtually nobody would be convinced by a social reason and not by an ecological reason. This suggests that messages might best focus on an ecological rationale for camping away from lakes, and indeed this is the most common rationale. However, some have questioned the validity of this rationale. Empirical data have shown that campsites close to lakes are not more highly impacted than camps away from lakes (Cole 1982).

It might be better, then, to focus on social reasons but to make them more compelling.

Many visitor characteristics influence visitor behavior and persuasibility, but relationships are not strong, so our ability to predict how people will behave or which ones might be readily persuaded is low. Those likely to have wood fires or to not be persuaded to camp farther from lakes than preferred include horse users, anglers, visitors who are highly experienced in this wilderness or highly attached to it, generally inexperienced wilderness visitors, visitors who are relatively insensitive to social and ecological impacts and visitors who are less supportive of rules and regulations. Where possible, managers may want to focus their attention on these types of visitors.

Our data indicate that progress has been made in persuading visitors to reduce fire use. Although we cannot prove it, we believe that progress has also been made in convincing people to camp farther from lakes. However, there is much

more room for progress, particularly regarding lakeshore set-backs. Much of the problem may be linked to the majority of visitors who feel there are no problems with impacts from wood fires and the minority who cannot be convinced there are good reasons to camp away from lakes. Our data can suggest the types of visitors who are most likely to be noncompliant. Targeting these visitors makes sense, although we should restate that none of the visitor characteristics we assessed explained much variation in behavior or persuasibility.

We suggest several avenues for further research. First, given the weak relationships we found with visitor characteristics, two potential interpretations could be made. It is possible that no visitor characteristics are important explanatory variables. Alternatively, however, there may be important visitor characteristics that differ from the traditional ones we surveyed. Research might uncover better visitor attributes to use as predictors. Second, there are no theoretical reasons we would expect horse users, anglers or visitors with high levels of experience in the local wilderness to be less compliant, persuadable, sensitive to ecological and social impacts or supportive of rules and regulations. Yet these were our empirical findings. Research might elucidate the underlying visitor characteristics that could better explain these findings.

Finally, the finding that more visitors are persuaded by ecological impacts than by social impacts is interesting. It is reminiscent of recent controversy in high-use areas in wilderness, where many visitors state they are willing to be regulated if regulation is needed to keep resource impacts to acceptable levels. However, they do not support regulations designed to provide high opportunities for solitude and other favorable social attributes. Research might attempt to understand whether these attitudes are common and where they come from.

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Examining Winter Visitor Use in Yellowstone National Park

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Abstract—This research was designed to assist the managers of Yellowstone National Park (YNP) in their decision making about winter visitation. The focus of this report is on winter use patterns and winter visitor preferences. It is the author's hope that this information will benefit both the quality of winter experiences and the stewardship of the park resources. This report addresses three fundamental questions: 1) Who are the visitors to YNP and why did they visit? 2) What are the characteristics of the winter visit and how do visitors travel within the park 3) What are the visitor evaluations of current social conditions? 4) Are potential management actions consistent with desired experiences?

Winter recreation use in Yellowstone National Park (YNP) has dramatically increased over the past three decades, imparting various challenges to park management. Management has identified many social issues such as overcrowding, visitor conflicts, and visitor behavior as central concerns (Greater Yellowstone Coordinating Committee 1997). Yellowstone National Park also is a proposed Wilderness and the central feature of one of the wildest remaining sections of the lower forty-eight states. Visitors have expressed contrasting concerns related to the impacts of motorized use on their winter experience. This study, investigates the social impacts of snowmobile use in YNP and examines the questions: What are visitor evaluations of current social conditions? And, are potential management actions consistent with the motivations and satisfaction of visitors? Are visitors willing to make tradeoffs with respect to the preservation of bison in the Park? These questions are typical of the issues facing many protected area managers.

While early explorations in wildland recreation research examined and characterized recreationists according to the activity in which they participated, the prevailing trend now is toward a more sociological and behavioral approach. This movement, spearheaded by researchers such as Driver, Tinsley, and Hendee, focuses on the psychological and physical benefits and outcomes that people receive or expect to receive through certain behaviors in certain recreation settings (Manning 1986). Known as the "unmet needs" hypothesis, this principle is based on the work of psychologists Lawler, Azjen, and Fishbein (Driver, Tinsley, and Manfredo 1990).

As recreational benefits were identified through research on a diversity of leisure types, researchers needed to create reliable methods of measuring those benefits. One example of a predominant motivation scale used to quantify the benefits of recreation is the Recreation Experience Preference (REP) Scale developed by Driver and his colleagues (Driver 1977). Motivation scales, such as Driver's REP scales, measure the importance of certain motivations or experiences for recreation along different domains, such as creativity, enjoying nature and thrill seeking. These scales can easily be adapted to measure reasons, feelings and satisfaction (Crandall, 1980). Since the development of reliable motivation scales, recreation researchers have studied the behavioral elements of leisure in a variety of contexts. Research has analyzed recreationists involved in a diversity of activities in a variety of settings from river anglers to cross country skiers to backcountry hikers (Knopf 1983, Manning 1986). Ultimately, the motive scales serve an important role in management by establishing "motive groups" and allowing managers to make decisions based on the preferences of these groups. Thus, wildland managers are encouraged to think of visitors in terms beyond uniform activity groups and rather as groups associated with common motivations, attitudes and expectations.

In our study information regarding motivations for visiting, satisfaction with certain experiences, and support for management actions was gathered from winter visitors to YNP. This effort undertook to aid managers in their evaluation of current setting conditions and visitor support for management actions. Understanding motivations, satisfaction and support for management actions provides managers with predictive tools related to visitor behavior and potential management initiatives. In this paper we will establish the methods used for data collection, we will provide the results of some of the analysis, and we will discuss underlying research themes and management implications.

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Study Methods

The goal of the research project was to gain information about Yellowstone National Park winter visitors' motivations, satisfaction, their support for a range of management action and to evaluate visitor travel dynamics. To this end, data were collected in three different forms: mail-back questionnaires, on-site surveys, and hourly oversnow vehicle counts.

Mail-Back Questionnaires

The bulk of the information gathered from YNP winter visitors was from the mail-back questionnaires. In this study, 1818 winter visitors to Yellowstone National Park were contacted at the four entrances to the Park, including the North (Mammoth), East (Cody), South (Flagg Ranch) and West (West Yellowstone) entrances. Names and addresses of visitors were collected, voluntarily, on thirteen randomly selected days in January, February, and March of the 1997-1998 winter season. Sample days included weekends and weekdays. Sampled followed a systematic random sample of the four entrances. Sample size at each entrance was proportionately representative of the number of visitors expected to be entering at each site. A random sample of 1505, approximately fourteen percent of the total visitors through each entrance, was mailed a questionnaire. The initial mailing and subsequent reminders yielded a response rate of seventy-one percent or 1064 questionnaires returned.

Onsite Surveys

To address a subset of questions about setting conditions, short on-site interviews were conducted at two sites on the interior of the park. The Old Faithful visitor center and the Fishing Bridge warming hut were selected for their diversity of location and visitation. Old Faithful is a high-use area and the Fishing Bridge has relatively low-use. Surveys at Old Faithful occurred on February 12, 13, and 27. Visitors at the Fishing Bridge were surveyed on January 30 and 31, February 14, 15, and 28, as well as March 1st. Visitors surveyed include those travelling by snowcoach and snowmobile. Two hundred and eight interviews were conducted; forty-seven percent at the Fishing Bridge warming hut and fifty-three percent at Old Faithful visitor center.

Hourly Snow Vehicle Counts: Results

The results presented here are directly related to current management issues including, the acceptability of current traffic conditions, the reasons why visitors came to the Park, visitor satisfaction with their experience, visitor classifications according to their motives, and support for management actions.

Individually, these aspects of the visitor experience each provide an integral piece towards understanding the relationship between visitors and YNP's winter setting and ultimately, what influence management initiatives may have on that relationship. Measuring the acceptability of potential traffic conditions within the Park reveals the socially constructed standards or norms with respect to crowding.

Acceptability of Traffic Conditions

In the mail-back questionnaire we asked visitors to rate the acceptability of encountering 0 to 50 snowmobiles per hour on a nine point scale running from -4, very unacceptable to +4, very acceptable (Fig. 1). This figure shows that the point at which the number of encounters crosses from the acceptable range to the unacceptable range is approximately 33 other snowmobiles encountered per hour. This data combined with information from the travel patterning model tells us that current conditions, in

terms of number of encounters and total daily visitation, would have to triple before respondents would deem these conditions unacceptable.

Motives for the Visit and Experience Satisfaction

One of the objectives of this study was to identify what motivates people to visit YNP and how these motives are linked to satisfaction and support for management actions. This type of analysis depends on the selection of a wide range of motivations with which visitors could identify. Scale items were adapted from extensively tested Recreation Experience Preference (REP) scales (Driver 1977) and a similar study examining winter recreationists to Voyageurs National Park (Lime and Lewis,1996). Respondents were asked to rate the importance of each reason to them and their visit to YNP. Respondents then identified for each item how satisfied they were with that experience. Table 1 illustrates the means, medians, standard deviations, and ranks of each of the items.

At a glance, the table shows that visitors were generally satisfied with their experiences in the Park. The medians here ranged from moderately satisfied (3) to totally satisfied (4). According to the means and subsequent ranks, natural scenery, wildlife, having fun, and viewing bison are the most important reasons respondents visited YNP. Of least importance to respondents were items such as developing skills,

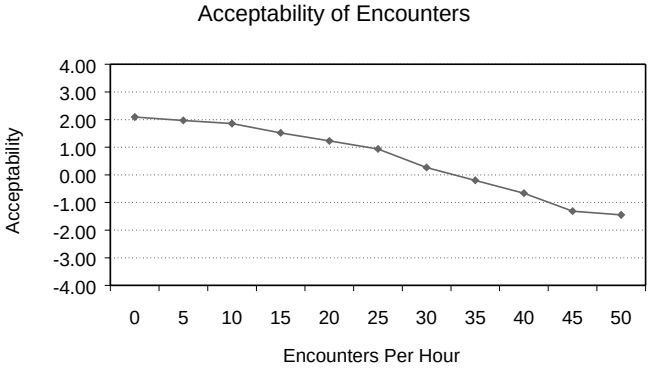

Figure 1—Acceptability of traffic conditions.

Table 1—Respondent ratings of reasons/experiences in importance and satisfaction.

Reason/Experience	Importance				Satisfaction				
	Mean	Med.	Std. Dev.	*R.	Mean	Med.	Std. D.	R.	**R.D.
Enjoy natural scenery	4.77	5	0.57	1	3.89	4	0.36	1	0
View wildlife	4.63	5	0.62	2	3.73	4	0.53	4	-2
Have fun	4.37	4	0.75	3	3.77	4	0.47	2	1
View bison in natural setting	4.22	4	0.91	4	3.69	4	0.63	6	-2
Get away from the usual demands of life	4.22	4	0.91	5	3.73	4	0.54	5	0
Experience the tranquility	4.18	4	0.92	6	3.46	4	0.79	18	-12
Snowmobile or ski in wild/natural setting	4.15	4	1.13	7	3.67	4	0.66	8	-1
Experience new and different things	4.07	4	0.87	8	3.64	4	0.56	9	-1
Do something with family	4.06	4	1.18	9	3.75	4	0.57	3	6
Have adventure	4.03	4	0.92	10	3.61	4	0.61	11	-1
Learn more about nature	4.01	4	0.91	11	3.54	4	0.64	13	-2
Learn about natural history	3.97	4	0.92	12	3.49	4	0.68	16	-4
See Old Faithful	3.95	4	1.1	13	3.58	4	0.76	12	1
Experience peace and quiet	3.79	4	1.12	14	3.28	4	0.87	25	-11
Be with people who enjoy same things	3.78	4	1.13	15	3.63	4	0.61	10	5
Be with members of my own group	3.75	4	1.22	16	3.69	4	0.56	7	9
Get away from crowds	3.67	4	1.15	17	3.10	3	0.96	40	-23
Do something creative	3.66	4	1.06	18	3.51	4	0.70	15	3
Experience excitement	3.59	4	1.08	19	3.48	4	0.69	17	2
Bring my family/group closer together	3.57	4	1.25	20	3.53	4	0.69	14	6
Experience solitude	3.51	4	1.2	21	3.25	3	0.87	29	-8
Learn more about cultural history	3.47	4	1.06	22	3.26	3	0.77	28	-6
Feel healthier	3.44	4	1.2	23	3.39	4	0.77	19	4
Be in an area where wolves exist	3.43	4	1.4	24	3.25	4	0.92	30	-6
Help reduce tension	3.24	3	1.28	25	3.38	4	0.8	21	4
Allow my mind to move at slower pace	3.23	3	1.28	26	3.37	4	0.81	22	4
Promote greater environmental awareness in own group	3.19	3	1.27	27	3.36	4	0.79	23	4
Be challenged	3.12	3	1.12	28	3.33	3	0.76	24	4
Have thrills	3.09	3	1.22	29	3.39	4	0.74	20	9
Reflect on and clarify personal values	3.04	3	1.18	30	3.27	3	0.8	26	4
Share what I have learned with others	3.01	3	1.24	31	3.27	3	0.81	27	4
Keep physically fit	2.92	3	1.17	32	3.2	3	0.85	34	-2
Talk to new and varied people	2.84	3	1.09	33	3.23	3	0.8	31	2
Rest physically	2.8	3	1.15	34	3.21	3	0.85	33	1
Feel more self-confident	2.76	3	1.17	35	3.23	3	0.84	32	3
Be at a place where I can make own decisions	2.69	3	1.21	36	3.11	3	0.91	37	-1
Help others develop skills	2.66	3	1.19	37	3.13	3	0.85	36	1
Develop skills	2.58	3	1.08	38	3.2	3	0.82	35	3
Be more productive at work	2.51	3	1.18	39	3.11	3	0.89	38	1
Escape family temporarily	2.11	2	1.13	40	3.11	3	0.98	39	1

*Rank by Means; **Rank difference between importance and satisfaction means; Importance: 1=Very important, 2=unimportant, 3=neither important or unimportant, 4=important, 5=very important; Satisfaction: 1=not at all satisfied, 2=somewhat satisfied, 3=moderately satisfied, 4=totally satisfied

becoming more productive at work, and escaping family. Respondents were also highly satisfied with their experience.

The ranks and the rank differences from Table 1 reveal items that may be of most interest to management, those that are highly important to respondents, but garner relatively lower satisfaction. These items have highly negative rank differences. Three items, experiencing tranquility, peace and quiet, and getting away from crowds, fall into this category. This suggests that while visitors are coming to YNP to find tranquility, peace and quiet, and to escape crowds, at least some of them are relatively less satisfied with what the Park offers in these areas. Conversely, respondents view being with their group and having thrills relatively unimportant, but are proportionately more satisfied with having achieved these ends (as reflected in the high positive rank differences).

Visitor Classifications According to Motivations

The importance ratings from the forty motive items were analyzed to reveal whether a simpler underlying structure could summarize and represent the motives. This was done by performing a principal component factor analysis. Reducing the number of variables in this manner provided us with a statistically more dependable measurement of reasons why visitors came to YNP. This procedure revealed six different underlying factors which we labeled according to their fundamental themes. These factors are shown in Table 2. These factors serve as summaries of the forty motives and will then be used to group respondents according to their scores on these factors.

Factor one, Self-help and Reflection, can best be characterized as the desire to attend to personal needs, like reducing tension, feeling healthier, and self-reflection. This factor represents an introspective motivation, including decision-making and self-confidence. Factor Two, Nature and Learning, can be described as motivations to learn about the natural and cultural history of the Park. This category includes viewing and learning about wildlife and nature. The third factor, Solitude, Peace, and Quiet, depicts motivations related to getting away from crowds, noise, and the hustle and bustle of everyday life. Experiencing natural scenery is also included in this factor. Opportunities for adventure and fun are fundamental to factor four, Thrills and Spills. This category includes thrill seeking and the desire to experience excitement. Motivations in factor five, Skills and Fitness, include physical challenge, skill development and keeping fit. The final factor, Family and Friends, emerged as the category representing social motivations. Items inherent in this factor include being with members of own group, bringing family or group closer together, and being with people who enjoy the same things. Thus, this tells us that the forty motivations utilized in the questionnaire do fall into distinct factor categories which represent broader motivations. When examined internally, these factors reveal reasonable and prudent underlying themes.

Defining Respondent Groups by Motivations for Visiting YNP

The six factors identified through factor analysis can be used to discern different groups or clusters of respondents according to their motivations. Using cluster analysis we identified the four clusters depicted in Table 3 These four groups best characterized our respondents, while maximizing the statistical differences between the clusters.

The Personal Growth cluster represents those respondents who rated items in the Self-help and Reflection factor as highly important to them or to their visit. Thirty-eight percent of respondents fall in this motive cluster. While the reflection and introspection are primary reasons respondents in this group came to YNP, they also rated the motivation items in the Learning and Nature category moderately high. Overall, these visitors are motivated to experience personal gains, in terms of feeling healthier, reducing stress, and learning about their environment. The social aspect of visiting Yellowstone, for example being with family or friends, is not as important to them.

Table 3 illustrates that learning about their environment is the fundamental reason why visitors in the Nature Study cluster came to YNP. Learning about the natural and cultural history of the Park, as well as viewing bison and other

Table 2—Factor summaries.

Factor 1: Self-help and reflection	Factor 2: Learning and nature
Help reduce tension	Learn more about natural history
Allow mind to move more slowly	Learn more about nature
To make own decisions	Learn more about cultural history
Be more productive	View bison in nature
Reflect on values	View wildlife
Feel more self confident	
Feel healthier	
Help others develop skills	
Factor 3: Solitude, peace, and quiet	**Factor 4: Thrills and spills**
Get away from crowds	Experience excitement
Experience peace and quiet	Have thrills
Experience the tranquility	Have adventure
Experience solitude	Have fun
Enjoy natural scenery	
Factor 5: Skills and fitness	**Factor 6: Family and friends**
Keep physically fit	Be with members of my own group
Develop skills	Do something with family
Be challenged	Bring my family/group closer together
	Be with people who enjoy same things

Table 3—Clusters.

	Personal growth	Nature study	Quiet activity	Accidentals
Factor	Mean	Mean	Mean	Mean
Self-help and Reflection	.6878	-.9555	-.6679	.3875
Learning & Nature	.3007	.6512	-.6698	-1.2879
Solitude, Peace & Quiet	.1058	-.4287	.9308	-1.2768
Thrills & Spills	.1850	-.2603	.0636	-.4594
Skills & Fitness	.1146	-.7126	.3952	.1128
Family & Friends	.0583	-.1705	.0915	-.4437

wildlife in their natural setting are highly important aspects of their visit. This cluster represents eighteen percent of respondents.

Visitors in the Quiet Activity segment, seventeen percent of respondents, seek solitude, tranquility and quiet in a physically challenging environment. These visitors come to YNP to maintain personal fitness and develop their skills away from crowds and noise.

Respondents in the final segment, Accidentals, did not rate any of the factors particularly high. They did show some motivation for reducing tension, feeling healthier, and becoming more productive, included in the Self-help and Reflection factor. These visitors are labeled Accidentals since they don't seem to share the same types of motivations found in most recreationists. Perhaps, other factors not specific to the experiences found in YNP motivated them to visit, or our group members made the decision to visit and their own motivations are not particularly tied to YNP. Over eight percent of respondents are represented by the Accidentals motive cluster.

Visitor Support for Management Actions

Gaining insight into support for potential management actions is valuable to managers who must make decisions that affect visitor experiences in the park. It is important to not only understand what management actions visitors favor, but also to identify the management actions that have little support from specific visitor types that may prove to cause future conflict.

Respondents were asked to express their support or agreement with various management actions under two different formats. First, respondents rated their support from one, "strongly oppose" to five, "strongly support on a series of management actions given the conditions of the Park on their visit. The management actions were generated from information supplied by NPS staff, planning and policy documents. Table 4 illustrates the most and least supported management actions. The means range from "oppose" (2) to "support" (4). The requirement of noise and emissions standards on all snowmachines gained on the most support

Table 4—Support for management actions.

Management actions	N	Mean	Med.	Std. Dev.
Require all snowmachines to meet strict, but reasonable emissions/noise standards	1051	4.02	4	1.08
Provide more info-appropriate behavior	1050	3.96	4	.93
Provide more info-snow/trail conditions	1052	3.80	4	.83
Provide more info-identifying points of interest along trails	1050	3.79	4	.93
Maintain and groom snowmobile trails more often	1049	3.74	4	1.17
Provide more info-things to see and do outside of YNP	1054	3.71	4	.95
Be more aggressive enforcing-snowmobile speed limits	1053	3.66	4	1.10
Be more aggressive enforcing-safety rules and regs	1049	3.62	4	.98
Provide more info-things to do in YNP	1046	3.59	4	.95
Continue and increase advertisement of other rec. areas	1047	3.56	4	.96
Provide more trails/locations for recreation use	1047	3.51	4	1.21
Provide more park rangers	1053	3.39	3	.89
Increase facilities provided to disperse use	1046	3.39	3	1.05
Provide guided snowmobile trips by NPS staff	1051	3.02	3	1.10
Establish alternate use periods	1036	3.01	3	1.08
Provide more winter accommodations	1049	2.90	3	1.20
Close roads to oversnow vehicles	1039	2.16	2	1.27
Restrict groomed roads to snowcoach travel only	1048	2.10	2	1.31
Plow road from W Yellowstone to OF	1046	2.02	2	1.27

1=strongly oppose, 2=oppose, 3=neither support or oppose, 4=support, 5=strongly support.

(mean = 4). The least supported management actions are related to changing the current status of the groomed roads. Respondents on average oppose closing roads to oversnow vehicles or restricting the roads to snowcoach use as do they oppose plowing the road from West Yellowstone to Old Faithful.

Respondents were then asked to rate the extent they agreed or disagreed with requiring visitors to follow a list of eight management initiatives in order to better protect the bison herd in the Park. The management initiatives range from the less intrusive, like limiting the size of groups and shortening the winter season to more intrusive including watching a compulsory video and implementing a permit system. The scale provided ranged from one, "strongly disagree" to five, "strongly agree." In general respondents did not agree with any of the requirements proposed to protect the bison herd. Table 5 shows that the means ranged from "neither agree or disagree" (3) to "strongly disagree" (1). Of those items implementing a permit system and restricting the days of the week visitors could travel in the Park garnered the least agreement. On average, visitors neither agreed or disagreed with limiting the size of visitor groups. This initiative had the highest mean.

Research Themes and Management Implications

There Is a Wide Diversity Among Winter Visitors

At first glance, it would be easy to assume that Yellowstone winter visitor's are fairly homogenous. Snowmobilers use the same mode of transportation, tend to look alike, and follow fairly similar and predictable travel patterns. The same may be said about people who come to ski or snowcoach. The data from this study, however, demonstrate that within each activity type, visitors seek distinctly different experience and should not be assumed to be seeking and enjoying a uniform type of experience dictated by activity type. Traditional recreation management principals suggest that managing for experience opportunities is generally preferred over managing for activities.

Recognizing that visitors are seeking differing goals has at least three implications for management. First, it would be easy for managers to assume that the visitors are homogenous. This could inaccurately lead to the assumption that visitors would respond to or support management actions uniformly. For example, in comparing Accidental Tourists with visitors seeking Nature Study (two of the clusters of visitor motivations) we see distinct differences in their support of management actions. The Accidental Tourist, for example, may not appear satisfied with any action but also may not have that great of investment with the outcome of the management. Where as a person seeking nature study may have a greater stake in the management action and would be willing to sacrifice slightly more of their experience to the perceived good of the natural resources.

Second, it would be easy to assume that snowmobilers are uniformly different from visitors who do not snowmobile. While visitors who snowmobile are more likely to be interested in personal growth or to be there "accidentally", visitors engaged in each type of activity are distributed across all four of the motivation clusters identified in this data. Similar dynamics occurs when looking at the distribution of visitor types that access the park from each entrance. That is, at each entrance we see a range of visitors in each motivation cluster, some seeking nature study, some peace and quiet, some fitness, etc.

Third, many of the visitors do more than one activity while in the park. Taken together, the use of experience motives is a more valid way to address the visitor segments than to consider the groups skiers, snow coach riders, snowmobilers or pleasure drivers. It also does not seem that the entrance one uses is closely related to the goals for a visit or assessment of management conditions.

Tying together the of the above-mentioned implications, it can be seen that managers are working with a visitor population that will be difficult at times to read. While they look and travel in similar patterns, they differ in their reason for visiting and assessing the park. Since goal interference is considered a primary influence on conflict among recreationists, it appears as likely for conflict to be occurring within visitor types as among them. Indeed, the slightly lower satisfaction levels of the accidental tourists may be associated with such conflicts (it is difficult to estimate the motivation this group would have to approach a manager with a complaint, however, since they are not as engaged within the park as the other visitors). Management strategies that increase the opportunities for nature study, personal growth and quiet fitness, are likely to be supported by a broad subset of the visitors.

Table 5—Support for management initiatives in order to protect the bison herd.

Management Initiatives	N	Mean	Med.	Std. Dev.
Limit size of groups	1043	3.01	3	1.25
Travel only in specific areas	1040	2.88	3	1.32
Watch 30 minute video	1046	2.55	2	1.21
Wait up to one hour before travel	1005	1.99	2	.91
Travel only at particular time of day	1032	2.10	2	1.06
Travel only on particular days of the week	1037	1.98	2	1.02
Travel only in shortened season	1031	2.12	2	1.12
Obtain a required permit	1039	1.95	2	1.10

1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree.

The Yellowstone Experience Is Satisfactory!

The winter visitor experience to Yellowstone National Park is a treasured one. From many visitors we have heard stories of extraordinary events, magical moments, and unforgettable images of one of the nation's greatest parks. Yellowstone in winter is a powerful experience and visitors feel fortunate in being able to see its treasures. There are those who view the winter as a resting period for the park and its denizens, a change to recover from the pressures of summer visitation. However, the winter visitors not only treasure the same peace and quiet, they are seeking out many of the same experiences that Yellowstone provides during the spring, summer and fall.

It is a park known for its wildlife – wolves, bison, and elk. It is a symbol of the nation, and features such as Old Faithful are powerful attractants at any time of the year. Visitors enjoy the opportunity to recreate, escape the usual routine of their daily lives, and to share their experiences with family and friends. Visitors are prepared to accept moderate levels of organization and regulation given the uniqueness and importance of the experience. Being kept to the roads, and the traffic congestion that sometimes this entails in both winter and summer is tolerable. Overall, satisfaction with the winter experience is very high.

The winter visitors to Yellowstone generally perceive the current management strategies to be fair and appropriate. There is not a perceived problem requiring drastic action. The winter visitors are supportive of management actions that would facilitate or improve the experiences they are currently afforded, such as requiring stricter emission standards for snowmobiles, greater enforcement of current safety rules and regulations, and the provision of more information about the park and its features. Management actions that are not supplemental to current conditions and that might disrupt or substantially alter the balance of experiential opportunities receive uneven support, or common levels of opposition. (One example that receives strong disapproval is the plowing of the road to Old Faithful).

It is not uncommon for visitors to recreation sites to be generally supportive of the status quo or to encourage of slight improvements. YNP's winter visitors' tolerance level of current conditions (or even greater levels of crowding) however, seems notable as does the opposition to a variety of management options that would constrain or curtail some of the current visitor activities.

For example, the lack of support for a variety of trade-offs that visitors might be asked to make in order to better protect the park's bison herd is surprising, particularly given the importance they express for wildlife values. Even moderate requests, such as watching a compulsory 30 minute video receive active levels of opposition. We suggest that winter visitors perceive either there is no problem with visitor interactions with the bison, or that suggested management actions would not have the desired effect on the bison herd, or that the actions suggested are inappropriate for protecting the bison. While the visitor may have heard about the problem, there is little impetus for change generated by his or her own experiences within the park. Things seem and feel OK, and perhaps their generally high levels of satisfaction with this special and unique opportunity flavors their perceptions of the park and its management. This might be indicative of many wildland planning and management contexts. Generally, visitors are supportive and appreciative of the recreation opportunities provided and resist putting these opportunities at risk. The status quo is very powerful and the public is often suspicious of manager motivations for changing these conditions.

There Is Time for Good Planning

While winter use issues within Yellowstone National Park are embroiled with tension and controversy, the majority of the visitor experiences within the park are fairly intact. In the absence of another surge of demand or a dramatic alteration of the experience by a management action, it is likely that satisfaction levels will remain high. Although there is a possibility that some people have been displaced and are therefore unaccounted for within this sample, the visiting population of winter users in Yellowstone National Park are highly satisfied. These data suggest that managers have a window of opportunity here in which planning efforts can be conducted and the implementation of such plans gradually applied. The urgency to address issues associated with winter use in YNP is not originating from the majority sentiment of the winter visitors.

Recommendations for Wildland Managers

We have demonstrated that seemingly appropriate approaches to measuring crowding (by only asking evaluations of current conditions) and to typifying visitor groups (by activity segment) may be overly simplistic. Instead, we have demonstrated underlying motive groupings and a modeling-based approach to measuring social condition evaluations. We believe these alternative approaches will be more useful for managers, particularly in predicting future visitor behaviors and likely support for management actions.

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Measures of Wilderness Trip Satisfaction and User Perceptions of Crowding

Chad P. Dawson
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Abstract—The inverse relationship between user perceptions of crowding and satisfaction with the wilderness experience was studied in three national wilderness areas in Oregon (1991) and in four state wilderness areas in the Adirondack Park of New York State (1997). User perceptions of crowding were correlated (low negative coefficients) with user satisfaction on the wilderness trip experience, but only a small proportion of the total variance was explained in the path analysis models. The authors emphasize that future research should identify what contributes to wilderness trip satisfaction since satisfaction often remains high despite perceptions of crowding.

Wilderness managers, regardless of where they are located in the United States, are often concerned about managing recreational use levels. Some of the indicators of recreational use, and their impacts on other users, include user densities, opportunities for solitude, perceptions of crowding and user satisfaction with the wilderness experience. The general conceptual model is that user densities affect user perceptions of crowding which, in turn, affect user trip satisfactions (Graefe and others 1984; Manning 1985 and 1999; Shelby and others 1989). User perceptions of crowding are expected to be influenced by the numbers of other users within a specific place, the numbers of large groups, distance between users, the user expectations about numbers of other users in relation to the actual experience of use levels, and other variables (for example, user preferences, motivations, type of group). The satisfactions of users are, at least partially, influenced by their perceptions of crowding during wilderness experiences (Manning 1999). Measures of satisfaction have been used by recreation managers to assess current and changing social conditions; however, some authors suggest that satisfaction is difficult to measure (that is, it requires more than a single normative variable to measure) and may require complex models to appropriately and correctly assess fulfillment during the experience (Williams 1989).

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The intent of this study was to explore these density-crowding-satisfaction relationships with several data sets, using similar models to predict satisfaction. Based on previous studies, we expected that density and crowding would explain only a small portion of the variance in overall trip satisfaction. Several analytical techniques (parametric and nonparametric) are used to show that trip satisfaction is only partially influenced by user perceptions of crowding during wilderness experiences. The implication is that positive indicators of satisfaction may help explain more about overall trip satisfaction than density and crowding, which are potential negative influences on satisfaction.

Methods

The selected wilderness user studies had to include similar variables for exploring the density-crowding-satisfaction relationships. The relationship between user perceptions of crowding and trip satisfaction was studied using data collected in four state wilderness areas in the Adirondack Park of New York during the summer of 1997 and in three national wilderness areas in Oregon in 1991. The New York State definition of wilderness is nearly identical to the national wilderness definition, with only minor differences, and the recreation management issues and approaches are similar.

The general research design was to sample users at high-use trailheads and conduct brief field interviews. A follow-up mail survey was then conducted with reminders, as necessary. Of the users briefly interviewed and sent a mail survey, 67% to 82% responded to those surveys (table 1). All statistical tests were conducted using the Statistical Package for the Social Sciences (SPSS version 7.5 for Windows, AMOS for SPSS version 3.61, and Answer Tree 2.0) software package.

Table 1—Comparison of the seven wilderness user survey returns and response rates.

Wilderness area	Mail survey response rate	Sample size for analysis
New York State (1997)		
High Peaks	67%	462
Siamese Ponds	74%	72
Ha-Da-Ron-Dah	75%	69
St. Regis Canoe	75%	183
NWPS in Oregon (1991)		
Mt. Jefferson	82%	594
Mt. Washington	80%	241
Three Sisters	82%	636

Six variables were analyzed from the mail survey data in the four state wilderness areas of the Adirondack Park:

- total number of hikers/canoes seen on the trip (continuous variable),
- total number of large groups seen on the trip (continuous variable),
- number of hikers/canoes seen compared to what was expected (five-point scale),
- number of large groups seen on the trip compared to what was expected (five -point scale),
- user perceptions of crowding (five-point scale), and
- overall trip satisfaction (five-point scale).

The six variables in this analysis were tested for statistical differences between the four wilderness areas, using ANOVA to determine if any of the data sets were similar enough to be combined. Statistical analysis included: (1) measuring correlation coefficients between the six variables, (2) predicting satisfaction using a conceptual model with a path analysis technique (first five variables are independent and satisfaction is the dependent variable), and (3) segmenting users group by their responses to the satisfaction question and the other five variables. There are some differences in how these variables were measured in the St. Regis Canoe Area compared to the other three wilderness areas (for example, number of canoes compared to number of hikers, three response categories compared to five categories for perception of crowding).

Five variables were analyzed from the mail survey data in three national wilderness areas in Oregon:

- total number of hikers seen on the first day of the trip (continuous variable),
- total number of hikers within speaking distance on the first day of the trip (continuous variable),
- number of hikers seen compared to what was expected (five-point scale),
- user perceptions of crowding (nine-point scale), and
- overall trip satisfaction (10-point scale).

The five variables in this analysis were tested for statistical differences between the three wilderness areas, using ANOVA to determine if any of the data sets were similar enough to be combined. Statistical analysis included: (1) measuring correlation coefficients between the five variables, (2) predicting satisfaction using a conceptual model with a path analysis technique (first four variables are independent and satisfaction is the dependent variable), and (3) segmenting users group by their responses to the satisfaction question and the other four variables.

Results and Discussion

The analysis results are presented in the following order: (1) the ANOVA results are used to determine if the data sets are similar enough to be aggregated together for subsequent analysis, (2) the bivariate correlation coefficients to show the relationships between the variables used to construct the prediction and segmentation models, (3) the user satisfaction prediction model using a maximum likelihood path analysis, and (4) the segmentation of user satisfaction using a nonparametric model.

Aggregating Wilderness Area Studies

The six variables from the studies of users in the four state wilderness areas of the Adirondack Park were tested in an ANOVA procedure to determine if the data sets were similar and could be used in aggregate instead of as four separate area comparisons. The results of the comparisons using both the Scheffe and LSD ANOVA statistical tests ($p<0.10$) indicated that there were significant differences between the High Peaks users and three other wilderness area user groups on five of the variables. The responses of Siamese Ponds, Ha-Da-Ron-Dah and St. Regis area users were not significantly different for the five independent variables. The only variable for which there was no statistically significant difference between the four areas was trip satisfaction (dependent variable). Based on the differences between the High Peaks user responses and the other three wilderness areas, the following analysis results are divided into two groups: (1) High Peaks Wilderness users, and (2) the Siamese Ponds, Ha-Da-Ron-Dah and St. Regis area users aggregated together.

The five variables from the studies of users in the three national wilderness areas in Oregon were tested in an ANOVA procedure to determine if they were similar and could be used in aggregate instead of as three separate area comparisons. The results of the comparisons using both the Scheffe and LSD ANOVA statistical tests ($p<0.10$) indicated that there were significant differences between the three area user groups for most of the variables. Thus, the following analyses consider each of these three area studies separately.

Bivariate Correlations

The average number of users seen on a trip in the New York areas ranged from 10 users (or canoes) in the Siamese Ponds, Ha-Da-Ron-Dah and St. Regis Canoe area to 45 hikers in the High Peaks Wilderness. The relationship between the number of hikers/canoes seen on the trip and the number seen, compared to what was expected, was an overall positive Pearson correlation coefficient (table 2). The correlation coefficients between these two variables were very similar for the High Peaks and other three wilderness areas, even though the average number of users seen in the High Peaks was substantially higher than the other three areas. The number of large user groups (more than 10-12 users) seen on a trip in New York areas ranged from one group in the Siamese Ponds, Ha-Da-Ron-Dah and St. Regis Canoe area to two in the High Peaks Wilderness. The relationship between the number of large user groups seen on the trip and the number seen, compared to what was expected, was an overall positive Pearson correlation coefficient (table 2). The correlation coefficients between these two variables were very similar for the High Peaks and other three wilderness areas.

The average number of user groups seen at a distance on a trip in Oregon areas averaged from one in the Mt. Washington Wilderness areas to two in the Mt. Jefferson and Three Sisters Wilderness areas. The relationship between the number of hiker groups seen at a distance on the trip and the number seen compared to what was expected was an overall positive Pearson correlation coefficient (table 2). The

Table 2—Pearson correlation coefficients[a] between variables in the wilderness user surveys.

New York State wilderness areas	Number of hikers/ canoes seen compared to seen and expected	Number of large groups seen compared to seen and expected	Seen and expected number of hikers/ canoes compared to perceptions of crowding	Seen and expected number of large groups compared to perceptions of crowding	Perceptions of crowding compared to satisfaction
High Peaks	0.26	0.29	0.47	0.30	-0.28
Siamese Ponds, Ha-Da-Ron-Dah, St. Regis Canoe	0.30	0.33	0.44	0.39	-0.37

NWPS Wilderness areas in Oregon	Number of hiker groups seen at a distance compared to seen and expected	Number of hiker groups seen within speaking distance compared to seen and expected	Seen and expected number of hiker groups compared to perceptions of crowding	Perceptions of crowding compared to satisfaction
Mt. Jefferson	0.18	0.31	0.38	-0.36
Mt. Washington	0.19	0.22	0.26	-0.12[b]
Three Sisters	0.21	0.37	0.39	-0.19

[a]All correlations are significant at p = 0.01 except one relationship.
[b]Correlation not significant at p = 0.01 or p = 0.05.

average number of user groups seen within speaking distance during a trip in the Oregon areas averaged from two in the Mt. Washington Wilderness area to four in the Mt. Jefferson and Three Sisters Wilderness areas. The relationship between the number of hiker groups seen within speaking distance on the trip and the number seen, compared to what was expected, was an overall positive Pearson correlation coefficient (table 2). The correlation coefficients between these two variables were very similar for all three wilderness areas.

Users were asked if they felt crowded during their trips to the New York wilderness areas. Overall, the five response categories and percent response were: 1 = no crowding (57%), 2 = slightly (22%), 3 = moderately (14%), 4 = very (6%), and 5 = extremely crowded (1%). The relationship between the respondent's perceptions about crowding and the number of hikers/canoes seen, compared to what was expected, on the trip was an overall positive Pearson correlation coefficient (table 2). Similarly, the relationship between the respondents' perceptions about crowding and the number of large groups seen compared to expected on the trip was an overall positive Pearson correlation coefficient (table 2). User perceptions of crowding increased substantially when the number seen was more or far more than expected.

Users in Oregon were asked if they felt crowded during their trips to the three national wilderness areas. The nine-point response categories ranged from not at all crowded to extremely crowded. The relationship between the respondents' perceptions about crowding and the number of hiker groups seen, compared to what was expected, on the trip was an overall positive Pearson correlation coefficient (table 2). User perceptions of crowding increased substantially when the number seen was more or far more than expected.

Users in New York were asked to report if they were satisfied with their experiences while on their trips to the wilderness areas. The five response categories for the question about being satisfied and overall percent response were: 2 = strongly agree (55%), 1 = agree (40%), 0 = neutral (3%), -1 = disagree (1%), and -2 = strongly disagree (1%). The relationship between the respondent's perceptions about trip satisfaction and crowding was an overall negative Pearson correlation coefficient (table 2). The correlation coefficients between these two variables were very similar for the High Peaks and other three wilderness areas.

Users in Oregon were asked to report, using a 10-point scale, if they enjoyed (were satisfied with) their experiences while on their trips to the national wilderness areas, compared to previous wilderness visits. The relationship between the respondents' perceptions about trip satisfaction and crowding were an overall negative Pearson correlation coefficient (table 2). The correlation coefficients between these two variables were different for the three wilderness areas; Mt. Washington survey data did not have a statistically significant correlation coefficient.

User Satisfaction Prediction Model

The independent variables were used to develop a maximum likelihood path analysis that predicted trip satisfaction. The models were conceptually developed based on the published literature and statistically formulated using a structural equation model.

The user satisfaction path model for the High Peaks and for the Siamese Ponds, Ha-Da-Ron-Dah and St. Regis areas is shown in figure 1. The results from this model indicate that there is a high degree of correlation (r) between the total number of users seen and the number of large groups seen. The numbers on top of each rectangle are the squared multiple correlations (R^2) with all previous variables. The relationships between perceptions of crowding and the expected compared to actual user numbers are the strongest relationships. In this multivariate path model, the relationships between perceptions of crowding and trip satisfaction are not as strong as might be anticipated from the bivariate relationships. Overall, this multivariate path model is acceptable and statistically significant ($p < 0.01$), but it

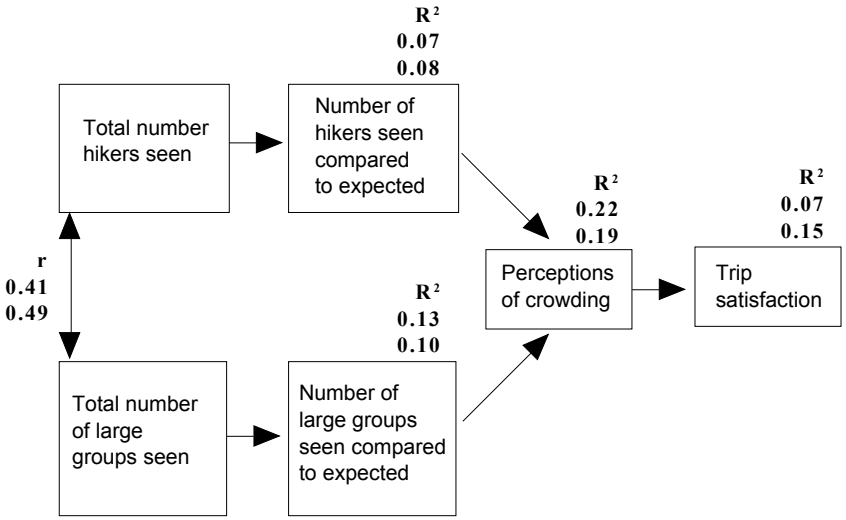

Figure 1—A path analysis model showing the r value correlations between the two exogenous variables and the R^2 values for the four endogenous variables for the survey of users at the High Peaks Wilderness (top number) and the combined Ha-Da-Ron-Dah Wilderness, Siamese Ponds Wilderness, and St. Regis Campe Area (bottom number) in 1997.

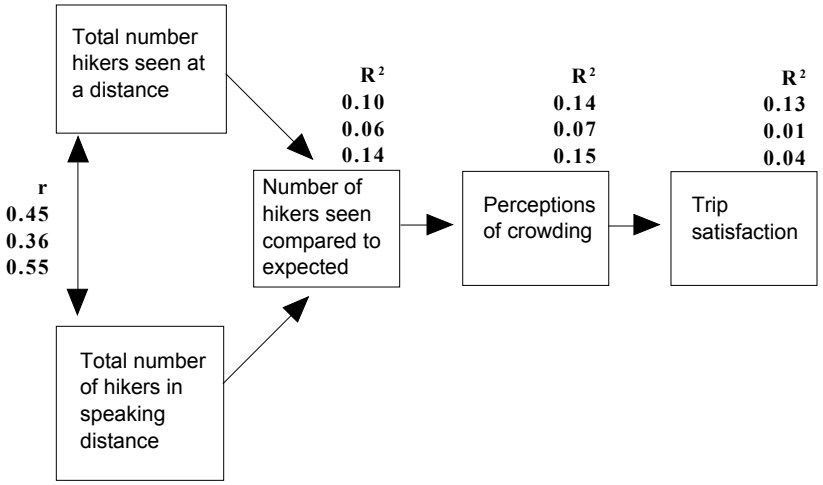

Figure 2—A path analysis model showing the r value correlations between the two exogenous variables and the R^2 values for the three endogenous variables for the survey of users in the Mt. Jefferson Wilderness (top number), Mt. Washington Wilderness (middle number), and Three Sisters Wilderenss (bottom number) in 1991.

explains only a small amount of the variance in the dependent variable—trip satisfaction.

The user satisfaction path model for the Mt. Jefferson, Mt. Washington and Three Sisters Wilderness areas is shown in figure 2. The results from this model indicate that there is a high degree of correlation (r) between the total number of user groups seen at a distance and the number of groups seen within speaking distance. The numbers on top of each rectangle are the squared multiple correlations (R^2) with all previous variables. The relationships between perceptions of crowding and the expected compared to actual user numbers are the strongest relationships. In this multivariate path model, the relationships between perceptions of crowding and trip satisfaction are not as strong as might be anticipated from the bivariate relationships, especially for the Mt. Washington survey data. Overall, this multivariate path model is acceptable and statistically significant ($p < 0.01$), but it explains only a small amount of the variance in the dependent variable—trip satisfaction.

User Satisfaction Segmentation

Since only a small portion of the variance was explained in the maximum-likelihood path analysis, there was some concern that the additive linear relationship between the

independent variables and dependent variable might not accurately represent the proposed causal relationship. Another way to explore the relationship between the respondents' trip satisfaction and perceptions about crowding was to use a nonparametric test that included a Chi-squared goodness-of-fit test. The CHAID algorithm in SPSS was used to separate discrete segments of users based on their responses to the trip satisfaction variable and the independent variables. All independent variables were used in the segmentation attempts.

The user segmentation analysis for the High Peaks Wilderness area (table 3) reported a statistically significant difference (Chi-square = 23.5, df = 1, $p < 0.01$) between two user segments who were: (1) very satisfied and perceived no crowding or only slight crowding, and (2) satisfied and perceived moderate to extreme crowding. Only the perception of crowding variable provided any discriminatory power in this segmentation; no other variable made a statistically significant contribution.

The user segmentation analysis for the Siamese Ponds, Ha-Da-Ron-Dah and St. Regis areas (table 4) reported a statistically significant difference (Chi-square = 16.5, df = 1, $p < 0.01$) between two user segments who were: (1) very satisfied and perceived no crowding, and (2) satisfied and perceived slight to very crowded. Only the perception of crowding variable provided any discriminatory power in this segmentation; no other variable made a statistically significant contribution.

Table 3—Reported satisfaction by High Peaks Wilderness users and their feelings about crowding based on segmentation analysis.

	Feelings about crowding		
Satisfaction rating	Not crowded or slightly crowded (n = 259)	Moderately to extremely crowded (n = 90)	Total (n = 349)
	---	*Percent*	---
Very dissatisfied	0.8	2.2	1.2
Dissatisfied	0.0	5.6	1.4
Neutral	1.5	5.6	2.6
Satisfied	35.9	**50.0**	39.5
Very Satisfied	**61.8**	36.6	55.3
Total	100.0	100.0	100.0

Table 4—Reported satisfaction by Siamese Ponds Wilderness, Ha-Da-Ron-Dah Wilderness, and St. Regis Canoe Area users and their feelings about crowding based on segmentation analysis.

	Feelings about crowding		
Satisfaction rating	Not crowded (n = 172)	Slightly to very crowded (n = 111)	Total (n = 283)
	---	*Percent*	---
Dissatisfied	0.0	2.7	1.1
Neutral	1.2	3.6	2.1
Satisfied	33.1	**49.6**	39.6
Very Satisfied	**65.7**	44.1	57.2
Total	100.0	100.0	100.0

Table 5—Reported satisfaction by Mt. Jefferson Wilderness users and their feelings about crowding based on segmentation analysis.

	Feelings about crowding			
Satisfaction rating	Not crowded (n = 187)	Slightly to moderately crowded (n = 230)	Moderately to extremely crowded (n = 58)	Total (n = 475)
	---	---	*Percent*	---
1	0.5	0.0	1.7	0.4
2	0.5	2.2	5.2	1.9
3	0.5	2.2	15.5	3.2
4	2.1	2.2	5.2	2.5
5	6.4	9.5	13.8	8.8
6	4.8	5.6	10.3	5.9
7	12.3	17.4	**17.3**	15.4
8	19.9	**25.3**	15.5	21.9
9	16.0	20.0	12.1	17.5
10	**37.0**	15.6	3.4	22.5
Total	100.0	100.0	100.0	100.0

The user segmentation analysis for the Mt. Jefferson Wilderness area (table 5) reported a statistically significant difference (Chi-square = 54.3, df = 2, $p < 0.01$) between three user segments who were: (1) very satisfied and perceived no crowding, (2) satisfied and perceived slight to moderate crowding, and (3) satisfied and perceived moderate to extreme crowding. Only the perception of crowding variable provided any discriminatory power in this segmentation; no other variable made a statistically significant contribution.

The user segmentation analysis for the Mt. Washington Wilderness area reported that no variable made a statistically significant contribution to segmenting user satisfaction (that is, users could not be segmented into different satisfaction groups based on any of the four independent variables).

The user segmentation analysis for the Three Sisters Wilderness area (table 6) reported a statistically significant difference (Chi-square = 19.6, df = 1, $p < 0.01$) between two user segments who were: (1) very satisfied and perceived no crowding or slight crowding, and (2) satisfied and perceived slight to extreme crowding. Only the perception of crowding variable provided any discriminatory power in this segmentation; no other variable made a statistically significant contribution.

Conclusions

Correlations between the variables within the path model are as expected, according to the published literature, but they explain only a small portion of the total variance in trip satisfaction. The level of expected use varies between higher and lower density wilderness areas, but when user expectations are exceeded, users feel more crowded. Satisfaction is partially influenced by perceptions of crowding, usually

Table 6—Reported satisfaction by Three Sisters Wilderness users and their feelings about crowding based on segmentation analysis.

Satisfaction rating	Feelings about crowding: Not crowded (n = 361)	Moderately to extremely crowded (n = 170)	Total (n = 531)
	--------- *Percent* ---------		
1	0.8	0.6	0.7
2	0.3	1.8	0.7
3	3.0	4.1	3.4
4	1.4	2.9	1.9
5	7.2	11.2	8.5
6	5.2	9.4	6.6
7	12.2	16.5	13.6
8	22.2	**28.3**	24.1
9	15.3	11.7	14.1
10	**32.4**	13.5	26.4
Total	100.0	100.0	100.0

with some negative affect on satisfaction, particularly when crowding is perceived as moderately to extremely crowded. However, the appropriateness of using a density-crowding-satisfaction model (that is, without positive influences) is questionable, since only a small proportion of the total variance was explained in the path models. Manning (1999), in a recently published book, suggests additional components and concepts that will further expand the satisfaction model.

The user segmentation tended to verify that satisfaction and perceptions of crowding are related. While most of these results are statistically significant, and generally as anticipated, some cases in the data sets raise questions about why perceived crowding appears to have no negative affect on some users' satisfaction and why some users are not satisfied but have not perceived crowding to be an issue. Clearly, there are many other factors besides perceptions of crowding that affect satisfaction, and some researchers are measuring those influences (Whisman and Hollenhorst 1998) or are recommending such measures (Manning 1999).

These results, and other published studies on the density-crowding-satisfaction model, generally show that satisfaction is only partially explained by user density (encounters) and perceptions of crowding. However, we are concerned that wilderness managers who want to monitor recreational experiences are using these density-crowding-satisfaction variables as indicators to assess changing conditions and to determine if direct or indirect management actions are needed to reduce crowding.

We and others (Manning 1999) recognize that further refinements in the density-crowding-satisfaction model are necessary and appropriate. We conclude that the more important question may be "what are the positive influences on wilderness trip satisfaction?" We emphasize that future research should identify what contributes to wilderness trip satisfaction, since satisfaction often remains high despite perceptions of crowding. Based on our research and the published literature, we recommend that future research on satisfaction focus more on how to: (1) operationalize the concept of satisfaction as a multi-dimensional scale of items and not as a single item, (2) use multi-method data collection techniques, both quantitative and qualitative, to better describe and explain user satisfactions, and (3) develop a more complex model of the positive and negative social and human dimensions of the wilderness experience to better predict satisfaction.

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An Individual-Based Modeling Approach to Simulating Recreation Use in Wilderness Settings

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Abstract—Landscapes protect biological diversity and provide unique opportunities for human-nature interactions. Too often, these desirable settings suffer from extremely high visitation. Given the complexity of social, environmental and economic interactions, resource managers need tools that provide insights into the cause and effect relationships between management actions and social and environmental outcomes. Object-oriented technology, along with spatial geo-referenced temporal data, provides new opportunities for developing, testing and improving simulation models. This paper describes a case study in Sedona, Arizona, that utilizes prototype software package the *Recreation Behaviour Simulator (RBSim)*, to dynamically simulate the behavior of human recreationists' in high-use natural environments.

Many people who travel to wilderness areas do so out of a desire to experience an environment that is uninhabited or appears to be unaffected by the activities of man. However, the activities of visitors in these environments, and their interactions with one another, may degrade the quality of their own experience. People according to Fege and others (1989) "come to wilderness with differing expectations about their recreation activities and wilderness resource, personal involvement in the activity or place, mode of perceiving or experiencing the wilderness, status-consciousness, and tolerance for other lifestyles." All of these have been shown by many researchers to be influenced by crowding and encounters in wilderness settings (e.g., Daniels and Krannich, 1990; Ewert and others 1993; Fege and others 1989; Ivy and others 1992; Jacob, 1977; Jacob and Schreyer, 1980; Schreyer, 1990; Scenic Spectrums Pty Ltd. 1995; Watson and others 1994).

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Recreation Use of Wilderness Settings

In order to manage for optimal recreation use of wilderness, managers must understand the needs, goals and desires of those sharing that environment and where encounters occur within and between groups of recreationists'. This is by no means an easy task with an evolving wilderness clientele and a resource base that is holding constant. In order to manage for optimal use of wilderness areas, managers must first acquire a better understanding of the nature and extent of encounters. It is quite clear from a review of the growing body of literature surrounding the issue of encounters and their affect on experience quality that:

- It is through encounters that "use levels" affect experience quality.
- Encounters lead to a sense of crowding for at least some (not all) visitors.
- Managers of Wilderness (as opposed to other lands) care especially about this sense of crowding and in particular "use levels" since they are legally obligated to provide opportunities for solitude.
- The effect of encounters appears to depend on the number and location of encounters, the type and behavior of those encountered and dispositional factors of the user (e.g., goals, expectations).

There is strong evidence that the distribution of recreation use across time and space in wilderness areas has profound effects on whether a certain level of use causes high levels of encounters among groups and perceived crowding (Scenic Spectrum Pty Ltd. (1995). Time and location of use not only affects the number and location of encounters, it also influences how these encounters are evaluated.

The purpose of this paper is to describe a prototype computer simulation system that was developed to study the affects of time and space on levels of use in wilderness settings. Specifically this paper will describe a computer simulation model that was developed as a tool to examine the number of encounters and their associated salient features (e.g., type and age of group) between and within activity groups over space and time under varying use scenarios in Broken Arrow Canyon, Sedona, Arizona.

Computer Simulation Models in Wilderness Settings

Computer simulation models have been proposed as one tool to resolve this complex problem of encounters in wilderness areas (Romesburg 1974; Cesario 1975). Because time and space (location) have a profound affect on levels of encounters, it is surprising that computer simulation has not been more extensively used. Computer simulation is not a new concept in studying natural processes, but it has seen limited use in studying wilderness recreation.

The Wilderness Use Simulation Model (WUSM) (Shechter 1975; Smith and Krutilla 1976; Shechter and Lucus 1978) was developed in the 70's to assist natural resource managers in assessing wilderness use. The simulator was developed and tested in both Spanish Peaks Primitive Area in Montana (Smith and Krutilla 1976) and the Desolation Wilderness in California (Smith and Others 1976) and subsequently modified for river recreation management (USDA Forest Service 1977) for use on the Green and Yampa Rivers in Dinosaur National Monument (McCool and others 1977; Lime and others 1978) and the Colorado River in the Grand Canyon (Underhill and Xaba 1983; Underhill and others 1986; Borkan 1986; Borkan and Underhill 1989).

While the tool was extremely innovative for its time, by today's standards it lacks the flexibility to undertake simulation of discrete visitor movement and associated behaviors along trails or rivers and fails to provide any mechanism for studying critical interactions between humans and environmental processes (such as communication and negotiation among visitors, adaptive learning for developing coping strategies, autonomous movement patterns according to individual needs and behaviors, beliefs, desires and intentions etc.). In addition, the current abundance of spatial georeferenced temporal data, which describes the earth's surface, provides more opportunity for testing and improving the accuracy of simulation models and with more direct applicability for resource managers.

Simulation approaches presented by (Manning and Ciali 1979; Manning and Potter 1984; Potter 1982; Potter and Manning 1984) and their recent studies (Wang and Manning 1999) incorporating Geographic Information Systems (GIS) to capture environmental data have shown great promise for modeling the impacts of recreation use in these settings but have not yet overcome some of the problems encountered with the WUSM. Their work does however clearly illustrate the usefulness of simulation for generating and testing alternative management scenarios to reduce encounters and improve the quality of the recreation experience.

While there have been more constrained models for assessing recreation site preference and choices (Schroeder and Louviere, 1986; Schroeder and others 1990), as well as encounters between groups of recreationists', there has been no dynamic, spatially explicit tool that provides recreation managers and researchers with the ability to systematically investigate different recreation management options. For example, with the introduction of a new trail one might expect that encounters would be reduced, but to what extent? How do recreationists' use coping behaviors to offset the impacts of encounters and crowding on their recreational experience? If some type of limited access is selected as a management option, what will be the impact on use patterns? More important, when there are different, conflicting recreation uses, how do different management options increase or decrease the conditions that lead to conflicts? None of these questions can be answered using conventional tools. These questions all pivot around issues such as time and space, as well as more complex issues such as inter-visibility between two locations on a map

In summary, there still appears to be a widespread gap between what the manager needs to adequately manage for high-quality wilderness recreation and the knowledge and tools that are available for doing so. Information about wilderness recreationist attitudes and behavior is increasingly viewed as important to the planning and management process, but collection of this data can be costly and sometimes produce very little that the manager can actually use in developing management options. With the rapid development of technologies such as Global Positioning Systems (GPS), GIS, and artificial intelligence, many new opportunities now exist to gather the kinds of data needed to build, test and validate a more elaborate modeling structure that incorporates a dynamic interplay of time, space and people/landscape interactions. A more appropriate concept calls for the interaction of four models: a model of desired and influential recreation setting parameters; a model that expresses the outcomes of recreation behavior in those settings; a model of recreation behavior that predicts the number of users per unit of time, in those settings from which personal, social and economic value estimates can be made, and a model that minimizes encounters within and between recreation groups (Richards and Gimblett 1995).

There are a number of alternative approaches to modeling and providing decision support for visitor management. An application of computer simulation and modeling technology, presented in this paper, is intended to demonstrate the potential for developing a practical model readily usable by wilderness recreation managers. The application will show:

- How decision-makers, such as natural resource managers, would benefit from inexpensive, simulation techniques that could be utilized to explore dynamic recreation behavior, develop thresholds of use and test ideas, before expensive management plans are implemented.
- How resource managers can have confidence in the use and results of these simulations, since the design of the behavioral systems that are utilized in the simulations are grounded in observations and data of actual human behavior in the physical settings in which they naturally occur.
- How simulation technology can be used to refine management strategies, as well as promote greater public understanding of management decisions.

Modeling Complex Human-Environment Interactions Using Statistical Analysis and Computer Simulation

To obtain a more thorough understanding of and manage for complex human-environment interactions, models that systematically and precisely specify the interrelationships

between the relevant human and environmental variables are required. There are significant obstacles, however, to the development of such models. The number of potentially important environmental variables is very large. Moreover, these variables are often complexly interrelated and interdependent. Many environmental interactions strongly depend on spatial/geographic factors, and they may change on a temporal scale ranging from moment-to-moment to century-to-century. The number of potentially important human variables is also large and completely interrelated and, in most contexts, includes the effects of interactions with other humans. Finally, both the humans and the environments involved may affect each other, altering subsequent environmental experiences and responses for affected humans and changing the environmental context for others who may follow.

Modeling human-environment interactions is a matter of discovering and representing the interrelationships between two complex constellations of interrelated variables. Empirically based statistical modeling methods, such as regression and variants thereof, provide a robust and well-tested approach for representing such multivariate relationships. Statistical models use rigorous method to make explicit the quantitative relationships among variables in complex data sets. These models can provide high degrees of precision and specified levels of sensitivity and reliability. However such approaches are limited. Relationships that may be relatively simple to specify at one point in space and time will require much more complex specifications if the relationship is spatially and/or temporally dynamic. As the number of variables increases, the amount of empirical data demanded can increase substantially. The form of statistical models can rapidly become very complex and difficult to understand. Moreover, it can be difficult to determine the extent to which an empirically based statistical model can be generalized to new situations where values for one or more relevant variables fall outside the range represented in the originating data set. Process models have a quantitative specification essentially like empirically based models, but the specified relationships are deduced from know relational principles and/or theories. These models can solve some of the problems encountered by empirically based approaches, and they have been used successfully to represent many important biophysical components of environmental systems. The development of these models requires a more detailed understanding of the processes that mediate relationships between variables than is typically known.

An alternative modeling approach is to use artificial intelligence techniques to capture and represent expert knowledge about relevant variables. These models can take several forms, but underlying most is a system of "rules" that specify how inputs (such as, environmental and/or social conditions) and outputs (such as, human reactions) are related. The rules in these systems are often initially derived from the opinions of domain experts, reducing empirical data demands. Rules are then abstracted and organized into a model, an interrelated system of rules, which is typically coded into a computer simulation program. The specific rules and interrelations among rules are extended and modified heuristically by iterative execution of the computer simulation and observing the patterns of inputs and outputs ("model behavior") under a variety of operating conditions.

Model performance may be evaluated by comparing outputs against relevant parameters of existing empirical data, perhaps including the calculation of indices of fit. More often, performance of the model (sensitivity, reliability and validity) is based on the judgement of the modeler and/or the domain experts involved. Good models are those that produce behavior perceived to be similar to the observed (or assumed or expected) behavior of the human-environment system being modeled. The level of "goodness" achieved is rarely quantified. Models can be queried to determine which rules were implemented to produce specific input-output relationships. This feature can be used to evaluate (via expert judgement) how closely the model reproduced processes thought to be operating in the modeled system. Making the operative rules explicit can also facilitate understanding of the model and, presumably of the system represented. In more complex systems, however, it may be as difficult to understand the behavior of a model as it is to understand the behavior of the human-environment system being modeled.

Pilot Project in Using Simulation to Study Recreation Encounters in Sedona, Arizona

The Recreation Behavior Simulator (RBSim) was developed to address the weaknesses of other modeling approaches (outlined above) and for examining complex land management. Detailed descriptions of the modeling techniques can be found in Gimblett and others (1996a; 1996b); Gimblett and Itami (1997); Bishop and Gimblett (1998); Gimblett (1998); Gimblett and others (1999); Itami (1999). RBSim was developed as a prototype tool that could easily be modified to simulate many other natural resource, planning or design processes (traffic modeling, wildlife/habitat interactions, recreation/wildlife conflicts).

As a pilot project, RBSim was developed in response to a need to examine encounters between recreation groups over time in Broken Arrow Canyon near Sedona, Arizona. The canyon is popular for day hikers, mountain bikers and people on commercial jeep tours because of the unique spectacular desert scenery of eroded red sandstone. The very popularity of this canyon represents a problem common to many popular wilderness recreation destinations. People are "loving the place to death" by overuse, with resulting negative impacts on the landscape and in the quality of the experience people have when they visit. Crowding, conflicts between hikers, mountain bike enthusiasts and jeep tours can create negative experiences in what should be a spectacular and memorable landscape setting, but very little is known about where, why and the intensity at which these encounters occur.

By simulating human behavior in the context of geographic space, it is possible to study the number and type of interactions a typical visitor will have. Interactive modeling techniques are used to instill human-like behavior into artificial agents to explore recreation planning alternatives. The recreationist agent developed in RBSim can gather data from their environment, make decisions from this information and change their behavior according to the situation

they find themselves in. Each individual agent has it's own physical mobility, sensory and cognitive capabilities and keeps track of encounters. The behavior of RBSim agents is guided by a set of parameters for social setting, individual disposition and environmental setting.

These behavioral parameters determine how an agent reacts when encountering other agents, at what speed an agent travels through a landscape derived from a Geographic Information Systems database, how often and for how long an agent must rest, the recreational goals of the agent for a given landscape, the route the agent will follow through the landscape and for how long the simulation will run. In effect, the user is able to create different behavioral patterns and personality types for classes of agents, and program (individual and interaction rules into each agent), based on social and demographic data gathered from field study.

Defining Characteristics of Individuals to be Represented by Artificial Agents

For the Sedona example which characteristics of groups of recreationists' were developed using a pre and post trip on-site visitor use survey employed over a nine-month period to capture data on recreational use, desired beneficial outcomes and conflicting recreational uses in the canyon. Trip motives, expectations, use density, reported contacts and place of encounters have been identified as contributing factors to a recreational experience (Scenic Spectrums Pty Ltd. 1995). The two-phased measurement technique used to solicit response on the type of benefits that were desired (trip motives and expectations) during their visit and to what degree they were able to obtain them. This measure of conflict coincided with Jacob and Schreyers's (1980) goal interference definition of conflict. Visitors were asked if a range of benefits were desirable (*goals and intentions*) and whether they could obtain those benefits over time (*goal interference*). The benefit types used in this study are well documented in Bruns and others (1994) and Lee and Driver (1992), based on research undertaken on other public lands.

Of the (n = 1041) visitors sampled, three significant recreation use groups were identified; day-use hikers (n = 337), mountain bikers (n = 393) and commercial jeep passengers (n = 319). For more detailed demographic data, see Gimblett (1998). While there could be many combinations of personality traits derived from the visitor data collected, to demonstrate the utility of the agent modeling system, the recreationist patterns were aggregated into two unique types for both the hikers and mountain bikers. These two types are referred to as either a '*landscape*' or '*social'* recreationist type. Each desired significantly different benefits from their recreation experience at Sedona. Due to the nature and mode of travel, commercial jeep passengers were modeled as a jeep unit.

A *landscape recreationist or agent type* is one who seeks out landscapes that are *physically challenging and avoids crowds,* subsequently leading to a *reduction in stress*. In the exit interviews, visitors representative of this agent class indicated that they would only stop in locations where there were no other recreationist and move as fast as possible along the trails. Physical exercise was a strong motivation in this recreation group and common to both hikers and mountain bikers. These recreationists fall within the personal well being and health benefits class identified in Bruns and others (1994).

A *social recreationist* or *agent type* is more group-oriented, one who seeks out those landscapes which *are not necessarily physically challenging* but tend to build *self-confidence*, provide more *opportunity to learn more about the natural and cultural history* of the area and interact with others who share these goals. Visitors that were associated with the social agent class were more tolerant of meeting others along the trail. During the exit interviews, recreationists who represented this class indicated that they liked social interaction while engaging in their favorite recreational activity and would spend longer periods of time wandering through the landscape, sitting in special locations and contemplating life. For more details on the statistical analysis, see Gimblett (1998).

Rules for Artificial Agent Behavior

Rules for providing simulation agents with the social behaviors of human recreationists were derived from surveys of what respondents told us about their experiences, statistical analyses presented earlier and through interviews following their outing. While the surveys clearly documented that visitors spent a minimum of two hours performing their activities, the benefit questions provided the goals and intentions for their visit. Survey maps were used to provide a clear indication of where they rested, their final destination or where they stopped to view cultural and geologic features. Many of those recreationists that subsequently fell into the social agent class indicated that they stopped at all the locations, regardless of the numbers of other hikers or bikers that were present, and stayed primarily on the appropriate trail for their activity. Some mountain bikers and hikers who fell into the landscape agent classes indicated in both the survey and later in the exit interviews that they would stop at the cultural and geologic features only if there were a limited number of other recreationists' present. They also indicated that they would go out of their way to pass others along the trails quickly and avoid them if possible.

For the testing of the prototype agent simulator, a number of the rules were developed that conformed to what was learned about the intensity of use, interactions and subtle behaviors of visitors using Broken Arrow Canyon. They are:

1) All hikers and bikers rest when down to 25% energy level (was calculated from what visitors told the research team about how often they needed to rest during their trip).

2) Landscape agents, pass other agents in front traveling 25% slower than themselves and if they have at least 50% energy left.

3) Landscape agents slow down at landscape features if no other recreationists are present.

4) All agents stop at all landscape features.

5) Social hikers change their velocity to match other social hikers they encounter.

6) Hikers and bikers will not stop at features if more than five other agents are present.

How It Works

The RBSim runtime simulation engine runs in discrete time steps. At each time step in the simulation, each recreationist class (hikers, bikers and jeeps) is evaluated to determine if a new instance (agent object) of that class should be created (i.e., Enter the area). For each class of recreationist, a timer is set, which begins incrementing from the start of the simulation run and is reset to zero each time a new recreationist agent is generated. In the model parameterization, the minimum and maximum times between agents are specified. A random start time is generated between the minimum and maximum time each time a new agent is generated. A new agent of the respective class is generated once the timer reaches the randomly generated time.

Recreationist agents of the hiker, biker and jeep types are placed in collections for each type. The simulation engine then tracks each agent in each collection. Since the simulation engine is running on a synchronous clock, the order in which the agents are executed will affect consequences such as crowding and visibility. In order to avoid order effects from starting each agent's movement in a set sequence, it is randomized within each collection for each iteration of the simulation. Each agent has a single method called "Move," which triggers the execution of the internal rules and mobility for that agent. Once the agent has completed execution of all its behaviors for that time step, the run time simulation engine then executes the move method for the next agent in the randomized list for that iteration.

Each agent begins its journey in the GIS-based environment. Since agents have GIS analytic capabilities, they compute the slope of the cell they will move into next and scan around their neighborhood to locate the trail. They adjust their speed according to how steep the slope is and whether they are going up or down hill. When each agent moves, it computes both whether it can see any other agent in the simulation and also keeps track of encounters along the trail for further analysis. The agents will stop at viewpoints or any other suitable location depending on their personality type and interaction rules. This process continues in a loop until either all agents have completed their journey or the maximum time set for the simulation run is reached.

Example of a Typical Simulation Run

On the following page are examples of the type of simulation runs that can be undertaken using RBSim. These images show the run time interface to the simulation with jeep, mountain bikers and hikers during the simulation. Agents turn white on the screen when they have stopped to view the landscape or red when they have stopped to rest. As the simulation executes, agents can be seen evaluating where all other agents are in the landscape and using their rule sets to modify their behaviors. The accompanying graphing tool illustrates the number of visual encounters the agents are having with one another throughout the landscape (fig. 1). The graphic output provides a spatial view of where encounters are occurring, while the statistical data collected in memory for each agent are also spatially referenced but can be statistically analyzed to determine patterns of encounters.

Simulation using personality traits and behavioral rules synthesized from human recreationists provides a way to evaluate and test the effects of a variety of recreationist use densities over time. These alternatives can be used to develop new facilities along the trails, and to redirect trail use to maximize user satisfaction while minimizing impact. The ability to see the agents interacting under a variety of constraints can help the manager acquire a better understanding of how human recreationists use and interact on public lands.

One example that shows the power of using simulation is the impact of alternative routes on recreationist encounters. An examination of the biker trail alternatives, with routes suggested by the respondents to the survey, illustrates the importance of a well-thought out trail design on recreational encounters. In Sedona, two alternative trail designs would significantly reduce the number of encounters with other recreationists. It is clear that the simulation environment can assist in evaluating existing and proposed trails in attempts to minimize encounters and conflicts that can limit the quality of the recreational experience.

Summary

Although there has been extensive research into and development of multi-agent systems in robotics, artificial intelligence and automated decision-making, but few have incorporated the power of autonomous agent technologies with GIS to solve natural resource-related problems. This paper has presented and described some initial attempts at doing so. Multi-agent models have many advantages compared with those previously applied. Using agents to represent individuals or parties, incorporating GIS to represent the environment, and utilizing agent technology in natural resource management decision-making provide the following advantages:

Agents to Represent Individuals or Parties

- Agents have communication and negotiation abilities (for example, to decide to stop and camp or alter their plans to avoid encounters with other recreationists').
- Agents can be programmed with strategies, goals and intentions (where they want to hike and how they want to achieve that goal, how long they plan to spend and how difficult a route they wish to choose).
- Agents have adaptive learning capabilities to adjust to their surroundings and others they encounter (coping behavior) that are more in tune with current research into recreation behavior.

GIS to Represent the Environment

- GIS can provide a geo-referenced environment in which to view agent interactions and assess the number of encounters and where they occur over time.
- Makes the simulation model easy for policy-makers, planners, managers, and the public to understand

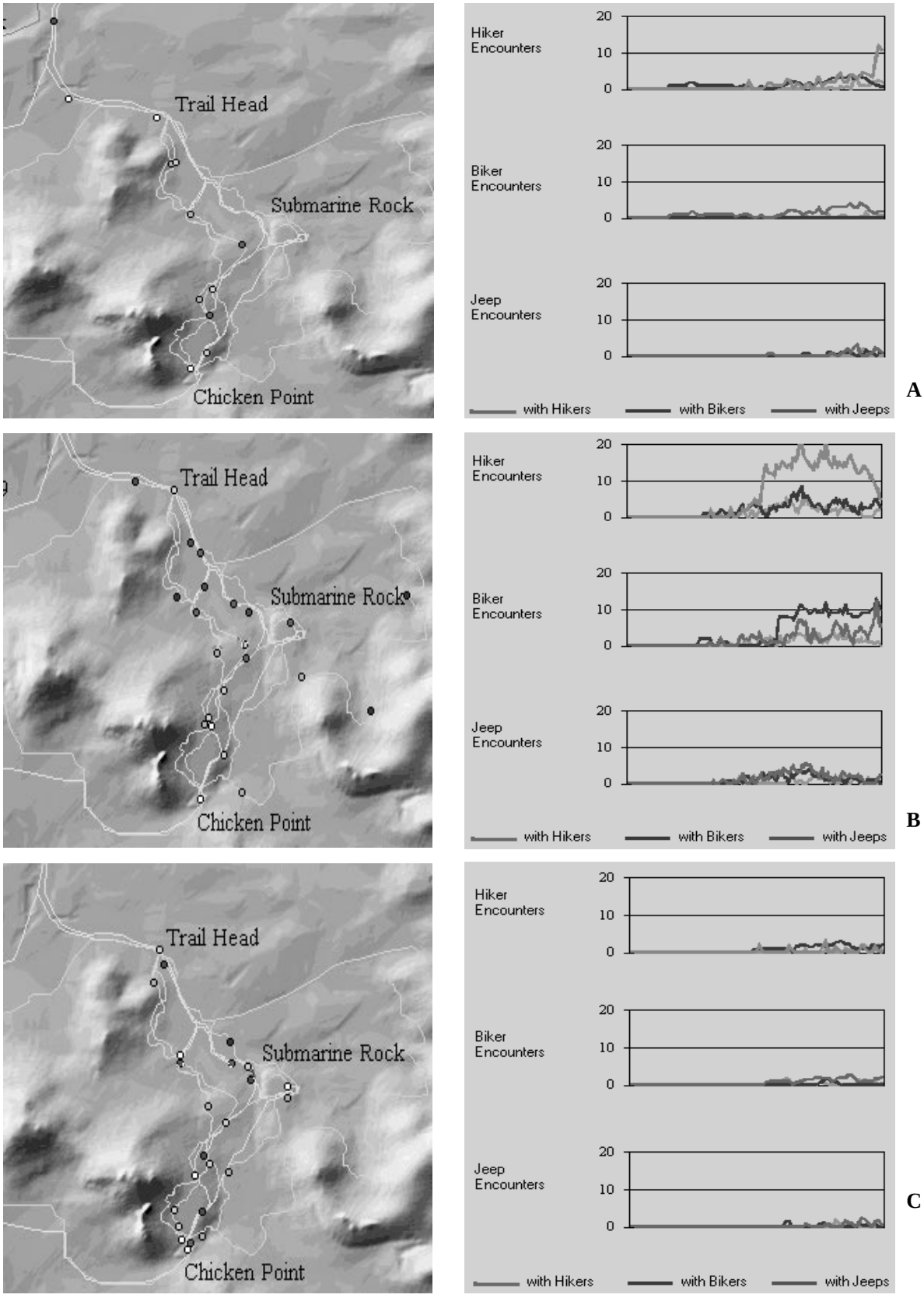

Figure 1—Examples of output from the simulation. Insert A is one slice in time during the simulation run. The graph is a measure of the number of encounters each of the recreation type is having with others as the simulation is running. Inserts B and C illustrate the differences in numbers of encounters when the same simulation conditions are repeated, but an alternative trail (C) is selected. It is clear from insert C that the number of encounters dramatically decreases when an alternative trail is selected. Both illustrate the power of using this simulation tool for examining a variety of management scenarios.

- GIS can be used to update the simulation with changing environment conditions (that is, as new information is captured in relationship to land use changes).
- Spatial analytic GIS classes (neighboring statistical summaries, inter-visibility analysis, distance measure, travel time, travel cost, slope, solar aspect, slope direction) provide a "tool box" of analytical capabilities that can be programmed into the agents. This decreases computation time and provides the agent with an enormous pool of spatial reasoning abilities.

Using Agent Technology as a Visitor Management Tool

- Agent technology allows wilderness managers to develop "what if" scenarios and provide options that will guide management decisions in resolving recreation use conflicts.
- Using a simulation environment composed of agents derived from data synthesized from human recreationists (individuals or parties) provides a way to evaluate the effects of a variety of recreationist use densities on different types of users.
- Using the visual display during the simulation of the agents interacting under a variety of constraints can give managers and others a more thorough understanding of how human recreationists use and interact on public lands.
- Agent technology can allows wilderness managers to explore the consequences of changes to any of the variables to manage desired experiences.
- Agent-based simulations provide a way for wilderness managers to explore and compare alternative management scenarios and evaluate them in terms consequences of policy actions and social, environmental and economic impacts.

Conclusion

This paper has introduced the idea of using multi-agent systems coupled with GIS and visitor use data to simulate and examine recreation use and associated interactions as a method for devising management strategies to reduce them. While the study outlined in this paper is by no means conclusive, it does illustrate great promise for modeling human/landscape interactions. However, much work needs to be undertaken to improve the predictability, reliability and validity of the proposed modeling framework.

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Relationships Between Trip Motivations and Selected Variables Among Allegheny National Forest Visitors

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Abstract—To meet visitors' needs, managers must understand the motivations driving visitors to wilderness areas. This paper compares the motivations of different segments of Allegheny National Forest users. Factor analysis identified 5 motivation factors (social, escape, fun, nature and learning), with two items retained as single item dimensions (close to home and challenge). Findings highlight that wilderness and campground users were motivated to visit by the need for escape. Overnight visitors were more apt than day-users to indicate escape, fun and challenge as motivational factors for their trip. Repeat visitors were more likely than first time visitors to mention escape and close proximity to home as their motivations to visit.

Participation in outdoor recreation activities has increased dramatically over the past few decades, and the current growth rate has been projected to increase further. Traditional outdoor recreational activities, such as day-hiking and backpacking, are expected to show substantial increases (Ewert 1995). To meet visitors' needs and optimize their satisfaction, managers must be able to identify the motivations driving visitors to wilderness areas.

Researchers have attempted to study the underlying motivations for participation in various outdoor recreation activities. Early motivational studies generally employed open-ended questions to explore potential motivations. The open-ended responses were instrumental in the formulation of motivational constructs (Manning 1999). However, the majority of empirical research has built on Driver and his colleagues' conceptual and empirical work dealing with Recreation Experience Preference (REP) Scales. This work is based on the concept that recreation is more than participation in an activity, and should be viewed as an experience providing various rewards or outcomes to participants (Driver and Brown 1975). Understanding what people seek through recreation can provide useful guidance to a variety of planning and management tasks, such as measuring supply and demand for recreation, developing management objectives, and preventing and managing conflicts between users. Practical application of this approach has been labeled "experience based management" and is part of the framework underlying the Recreation Opportunity Spectrum (Driver and Brown 1978).

Much research has been directed towards the development and testing of psychometric scales measuring the dimensions of recreation experience/motivation. Manfredo and others (1996) summarized the results of 36 different studies that have used REP scales. Their analysis generally supported the prevailing structure of motive domains (representing broad goal constructs) and scales (within-domain groupings representing dimensions of the broader goal construct). The analysis examined 108 of Driver's original 328 items (Driver 1983), representing 19 motivational domains. Crandall (1980) likewise assimilated 17 dimensions representing different types of motivations.

Individual studies have typically used smaller lists of items focused on domains hypothesized to be important for the particular activity and/or setting in question. Some of the more common motivational elements include escape, solitude, being close to nature, and social interaction. However, other elements have also been noted, including to relieve stress/reduce tension, recognition from others, to enjoy/learn about nature and family relations. Rosenthal and others (1982) examined the following eight motive domains for outdoor recreation: exploration, escape role overload, general natural experience, introspection, exercise, being with similar people, seeking exhilaration, and escaping physical stressors.

Participants have wide sets of motives and the range of motive importance varies across individuals and is dependent upon their goals (Mannell and Kleiber 1997). Empirical research has consistently shown that motivation dimensions differ for participants engaged in various activities. Motivations can also vary for participants in the same or similar activities. Graefe and others (1981) found that river users in two different areas responded similarly to factors related to learning/experiencing nature and stress release/solitude, but differed in their ratings of other motivational factors. Similarly, Knopf and Lime (1984) found that peace and calm and viewing scenery were ranked relatively highly among users of two rivers; however, the users differed on the importance of other motivational dimensions.

After studying rock climbers, Csikszentmihalyi (1977) concluded that they participated to experience the "flow"

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experience and to feel competent and in control (Levenson 1990). Another study of rock climbers also revealed motivations such as perceived competence and enhanced self esteem (Iso-Ahola and others 1986). In an attempt to identify various motivations of mountain climbers at Mount Rainier in Washington state, Ewert (1985), indicated that climbers were motivated by challenge, catharsis, recognition, creative opportunities, locus of control and the physical setting. In a subsequent study of mountaineers at Mount McKinley, Alaska, Ewert (1993) identified only five factors: exhilaration/excitement, social aspects, image, aspects of climbing and catharsis/escape. McIntyre (1992) employed 16 items from Ewert's research to analyze the motivations of rock climbers and found six factors: recognition, creativity, physical setting, challenge, escape and control. In the case of mountain bikers, exercise was the most important reason for participating, followed by nature/solitude/scenery, which was ranked slightly higher than challenge/excitement (Vilter and others 1995).

Based upon a review of 17 motivation studies involving anglers, Fedler and Dittion (1994) deduced the following dimensions: general psychological and physiological, natural environment, social, fishery resource and fishing skill and equipment (Dawson 1996). However, among Delaware State Park visitors, escape/solitude, nature/harmony, nature/learning, fun/recreation and social/interaction were identified as key motive dimensions (Confer and others 1996).

An important factor to consider in the study of motivations is the effect of nonmotivational factors on motivations. Variables traditionally used as independent variables (i.e. those that might influence motivations) include past experience (in general and site specific), skill level, group type and demographics. For example, as indicated earlier, Knopf and Lime (1984) found that first-time and repeat users of two rivers differed on the importance of several motivational dimensions. Similarly, Schreyer and others (1984) concluded that motives for river running vary with level of experience and frequency of participation.

In the sample of Mount McKinley mountaineers, those who reported a high level of experience indicated intrinsic elements such as using the mind, expressing creativity, self-expression and helping others (Ewert 1993). Mountaineers with low levels of experience sought competition, skill development and escape from normal life.

Group composition variables such as group size and type also influence motivations to participate in outdoor recreation activities. Participants with low levels of experience and skill are more likely to be part of a structured group or use a commercial outfitter (Ewert and Hollenhorst 1989). The size of the group and whether the group consists of friends, family or strangers affect motivation and satisfaction with the chosen recreation activity (Schuett 1994). When comparing participants who belonged to a guided group and solo mountain climbers, Ewert (1993) found that guided group members associated high levels of motivation with exhilaration and accomplishment, while solo climbers preferred to indicate that their motivation was due to the risks involved. Overall, solo climbers were more concerned with catharsis/escape than any other motivational factors.

In sum, the literature indicates that motivations for participation vary among individuals involved in outdoor recreation activities, and they are also influenced by the effects of nonmotivational factors. This paper examines the effects of selected variables on motivations among Allegheny National Forest users, notably users of the Hickory Creek Wilderness (HCW) and the adjacent buffer zones known as the Heart's Content Recreation and Scenic Areas.

Methods

The Hickory Creek Wilderness, located in northwestern Pennsylvania, encompasses 8,663 acres and features a secluded 11.2-mile loop trail. The buffer region (recreation and scenic areas) is coterminous to the HCW and is furnished with a campground (moderately developed), a day-use/picnic area and an old-growth forest with a short interpretive trail.

A combination of survey methods was used to collect the necessary data. A stratified sampling plan was developed to represent the major user groups of the national forest. Users of the Hearts Content Campground, Hearts Content Scenic Area and Hickory Creek Wilderness Area were contacted through an on-site survey during the 1997 summer season. Subjects completed a two-page personal interview and were asked to participate in a follow-up mail survey. The on-site survey response rate approached 99% (n = 269), with 94% of the respondents (n = 253) providing usable mailing addresses.

Adjacent landowners, equestrians, and other stakeholders that might have been missed in the on-site survey were sampled with a mail survey methodology. These additional groups were identified as follows:

1. Adjacent landowners were selected from tax rolls acquired from the tax assessor's office in the two counties adjacent to the study area (Warren and Forest).
2. Equestrian users were identified from a list of attendees to an equestrian management meeting held by the Forest the previous year.
3. Additional Wilderness users were identified through a trail register at the entrance to the Hickory Creek Wilderness.

Both mail surveys utilized a modified Dillman approach including three first-class mailings. The initial packet included a letter describing the study, an 8-page survey and a self-addressed, stamped return envelope. For visitors in the on-site sample, this initial mailing was sent approximately one to two weeks after the on-site interview. The second contact, a thank you/reminder postcard, was sent approximately two weeks after the initial mailing. A third and final contact composed of a complete survey package (letter, survey & return envelope) was sent about two weeks after the postcard reminder to those individuals who had not responded to the first two contacts.

Response rates for the mail surveys ranged from 61% for the follow-up to the onsite survey (n =155) to 41% for the horse users (n = 99). About half of the adjacent landowners (47%, n = 178) and wilderness users sampled from the trailhead register (52%, n = 88) returned their questionnaires. No further attempt was made to contact nonrespondents.

Motivation was operationalized using 15 items measured on a 5-point Likert-type scale, ranging from 1 = not at all

important to 5 = extremely important. The items employed were based on the motivations literature, except for one item, "it is close to my home and easy to get to," which was included on the basis of local managers' perceptions of area use patterns. Nonmotivational variables included the type of user; first/repeat visit; trip type; and group type. To explore the potential motivation dimensions, a principal axis factor analysis with varimax rotation was employed. Reliability analysis was conducted to assist in interpreting the factor structure. Composite indices were developed for the motivation factors (computed as the mean values for those items assigned to each factor as discussed below).

For the purpose of analysis, the motivations were treated as dependent variables against four independent variables: user group; first/repeat visit; trip type; and group type. A series of one-way analyses of variance were conducted, with significance measured at the 0.05 level (2-tail significance). A Scheffe post-hoc test was used to determine significant differences in motivations across user groups. No post-hoc test was needed for the other independent variables showing significant differences in motivations because these variables were dichotomous.

Results

The sample was composed of five groups as follows: 29% of the respondents were wilderness users, 10% scenic area users, 17% campground users, 16% horse users and 28% adjacent landowners. About 41% indicated they were on their first visit to the area, while 59% were repeat visitors. Similarly, 74% were overnight visitors, while 26% were day-users. About 54% indicated they visited with their family members, 24% with friends, and 11% with friends and family, while 9% were alone. Table 1 summarizes the descriptive statistics and provides a general profile of the visitors.

The factor analysis of the motive items generated five factors explaining 57.5% of the total variance (Table 2).

Table 1—Profile of visitors.

Variables	Percentage (*n*)
User group	
Wilderness	29% (183)
Scenic area	10% (62)
Campground	17% (108)
Horse	16% (99)
Landowner	28% (178)
First Visit	
Yes	41% (111)
No	59% (157)
Trip Type	
Overnight	74% (175)
Day-user	26% (70)
Group Type	
Alone	9% (23)
Family	54% (143)
Friends	24% (65)
Family and friends	11% (29)
Other	3% (7)

Items loading highest on the first factor were related to social interaction or affiliation. These three items yielded a reliability coefficient of 0.80. Although this factor accounted for the most variance in the motivation items, it was actually the least important motive to the study respondents, with a mean importance value of only 2.49.

The second factor was dominated by items related to escape. Although two of these items ("to relieve tension" and "to get away from the everyday routine of life") showed weaker factor loadings, including these items in this factor produced the strongest scale reliability (alpha = 0.76) and seemed to make the most sense conceptually.

The strongest loadings for the third factor were for the items, "to have fun" and "to have a good time." The items, "to relieve tension" and "to get away from the everyday routine of life," also loaded moderately on this factor, suggesting that these are important elements of fun. However, the two fun-related items showed the strongest scale reliability by themselves (alpha = 0.80) and focused more clearly on the construct of having fun.

Items loading highest on the fourth factor were related to experiencing nature. The item, "to get away from the everyday routine of life," again loaded moderately on this factor, suggesting that nature provides a good escape from the routine. However, the maximum reliability (alpha = 0.81) was again found for the simpler factor based only on the two nature-related items. Experiencing nature was the most important motive to the respondents, as shown by a mean importance score of 4.56.

The final factor was dominated by two learning-related items, "to develop my knowledge" and "to learn about the countryside." These two items yielded a reliability coefficient of 0.74. One additional item, "opportunities to challenge myself," loaded moderately (0.401) on this factor. However, including this item in the factor lowered the scale reliability and complicated the interpretation of the factor.

In sum, most of the motivational items loaded cleanly on one factor, while four items failed to load clearly on any single factor. Two of these four items ("to relieve tension" and "to get away from the everyday routine of life") were assigned to factor 2 (Escape) based on their conceptual meaning and contribution to that factor's reliability. The remaining two items ("opportunities to challenge myself" and "it is close to my home and easy to get to") were used as single-item measures representing constructs different from those underlying the five motivation factors.

For the first independent variable, user group (wilderness, scenic area, campground, horse users and landowners), five of the seven motivational constructs showed significant differences at the 0.05 level (Table 3). Only the social and fun dimensions did not differ across user groups. Based on the mean values (a higher value indicates more importance of the motivation items), wilderness (mean = 4.67) and scenic area users (mean = 4.77) rated experiencing nature more important than landowners (mean = 4.39). The learning dimension was more important to scenic area users than to either adjacent landowners or wilderness users.

Campground users attributed the most importance to the escape dimension, followed by wilderness users, landowners, horse users, and scenic area users. Adjacent landowners indicated more importance than wilderness users for the motivation item, close to home. The final significant item,

Table 2—Factor loadings for motivations of Allegheny National Forest visitors.*

Questionnaire statement**	Factor 1 social	Factor 2 escape	Factor 3 fun	Factor 4 nature	Factor 5 learning
To be with people of similar interests	0.855				
To do things with other people	0.750				
To meet friendly people	0.634				
To get away from other people		0.857			
To be alone		0.742			
To relieve tension		0.429	0.455		
To get away from the everyday routine of life		0.356	0.364	0.350	
To have fun			0.793		
To have a good time			0.760		
To observe the beauty of nature				0.696	
To enjoy the sights, sounds and smells of nature				0.904	
To develop my knowledge					0.785
To learn about the countryside					0.666
Items not assigned to any factor					
Opportunities to challenge myself	0.165	0.360	0.101	0.002	0.401
It is close to my home and easy to get to	0.245	0.116	0.009	-0.005	0.168
Number of Items	3	4	2	2	2
Alpha	0.80	0.76	0.80	0.81	0.74
Eigenvalue	4.27	2.54	1.40	1.23	1.01
Mean Importance	2.49	4.00	4.09	4.56	3.14
% Variance Explained	28.48%	16.95%	9.37%	8.17%	6.71%

*Only factor loadings of 0.30 and higher are reported, except for unassigned items.
**Orginally coded on a 5-pt Likert-type scale where: (1) = not at all important, (2) = somewhat important, (3) = moderately important, (4) = very important, (5) = extremely important.
Total % variance explained = 57.70%.

challenge, was considered most important by wilderness users, followed closely by horse and campground users, while the landowners and scenic area users rated challenge considerably less important.

In general, the adjacent landowners and wilderness users stood out as the most divergent groups, differing significantly from at least one other user group. The wilderness users placed great emphasis on escape, nature and challenge. The adjacent landowners placed the most emphasis on finding places for outdoor recreation close to home. The scenic area users were particularly interested in learning about the area, and were the least escape oriented. Conversely, the campers were the most interested in escape and differed significantly from both the scenic area visitors and landowners in the importance of escape.

First-time/repeat visit was the next independent variable examined. This variable was operationalized as "Is this your first visit to the area?" Based on the ANOVA, three out of the seven motivational constructs reached significance at the 0.05 level (Table 4). The first significant dimension was learning. Those respondents who were first-time visitors attributed more importance to learning than repeat visitors. However, repeat visitors indicated more importance than first-time visitors for the escape dimension, as well as the single item, close to home.

Trip type, the next independent variable, was operationalized as "Is your trip today an overnight visit to the area or a day trip?" When ANOVA was conducted, four out of the seven motivational constructs reached significance at the 0.05 level (Table 5). Learning was more important to day users than overnight users. However, overnight users were likely than day users to attach more importance to escape, fun and challenge.

Table 3—Comparison of motivations between different user groups.*

Motivations	User groups					
	Wilderness	Scenic area	Campground	Horse	Landowner	F value
Nature Index[1]	4.67[a]	4.77[a]	4.65[ab]	4.48[ab]	4.39[b]	6.00***
Learning Index[1]	3.06[a]	3.7[b]	3.33[ab]	3.00[ab]	3.05[a]	3.61**
Escape Index[1]	4.16[a]	3.65[b]	4.26[a]	3.83[ab]	3.88[b]	5.67***
Close to home[2]	2.60[a]	2.31[ab]	2.77[a]b	3.07[ab]	3.10[b]	3.89**
Challenge[2]	3.29[a]	2.68[ab]	3.19[ab]	3.2[ab]	2.73[b]	4.24**

*Only motivations showing significant differences are shown. Values shown are mean importance scores. Values with different superscripts are significantly different at the 0.05 level based on Scheffe's post hoc test.
**Significant at .01 level (2-tail significance).
***Significant at .001 level (2-tail significance).
[1]Index.
[2]Single item.

Table 4—Comparison of motivations between first-time/repeat visitors.

Motivations	First visit		F value
	Yes	No	
Learning Index[1]	3.52	3.18	4.32*
Escape Index[1]	3.90	4.24	6.57*
Close to home[2]	2.19	3.02	15.10**

*Significant at 0.05 level (2-tail significance)
**Significant at .001 level (2-tail significance).
[1]Index.
[2]Single Item.

Finally, the group type variable was operationalized in five categories: alone, family, friends, family and friends, and other. Basically, this variable was employed to identify the composition of the visiting individual/group. Oddly enough, when ANOVA was conducted, none of the seven motivational constructs achieved significance at the 0.05 level. The closest dimension was fun, for which the *p* value was 0.06.

Discussion and Conclusions

Overall, the motivation dimensions (social, escape, fun, nature and learning) were consistent with prior research, and registered good reliability measures despite some indices containing only two items. The failure of two motivational items to fit cleanly within the factor structure is probably more of a methodological artifact than a substantive finding. The challenge item might have factored more cleanly if other challenge-related items had been included in the original list of motive statements. The "close to home" item is a new variable that is a more pragmatic concept and does not fit within the theoretical framework of the other motive constructs. Hence it is not surprising that this item did not factor neatly with the other motivational items.

Differences observed between the user groups were not surprising but did show some distinct aspects of the various groups. Scenic area users, who were essentially day users, were motivated to visit the HCW by the need to be around nature and learn about it. This was a logical finding as most of the scenic area visitors visited the area to see the old-growth forest. Also, many day-use scenic area visitors came with family members to picnic as well as to be in a relaxing environment. Campground and wilderness users were strongly motivated by the need for escape. Similarly, backpacking in the wilderness is a challenging feat and wilderness users indicated that challenge was an important motivation for visiting the HCW. Adjacent landowners and horse users were more likely to visit because the area was close to their homes and they had easy access to the sites. However, even these groups placed more importance on the other motives than on the fact that the area was "close to home."

Table 5—Comparison of motivations by type of trip.

Motivations[1]	Overnight	Day	F value
Learning Index[1]	3.22	3.60	4.55*
Escape Index[1]	4.21	3.79	7.71**
Fun Index[1]	4.28	3.97	5.65*
Challenge[2]	3.31	2.84	3.97*

*Significant at 0.05 level (2-tail significance).
**Significant at 0.01 level (2-tail significance).
[1]Index.
[2]Single item.

First-time visitors were motivated to visit by the need to learn about nature. This finding is not unusual, as first-time visitors are more likely to be curious about a new area/environment, in this case the old-growth forest. On the other hand, repeat visitors may lack the beginner's curiosity and are more motivated to visit to escape the daily grind. Similarly, day users are likely to be transient visitors, who visit the area to learn something new. Overnight visitors are campers and backpackers, who are essentially escaping their normal routine and are motivated by the need for challenge as well as fun. Finally, contrary to previous research, data in this study do not support the relationship between motivations and group type/composition. This was an unusual finding.

In spite of the differences observed, it is also important to recognize the commonalities among the various user groups. For example, all groups tended to rate experiencing nature as their most important motive. Likewise, all groups sought to have an enjoyable time and concurred that social interaction was a relatively unimportant motive for their use of the forest.

Study findings demonstrate that people visit the Hickory Creek Wilderness and surrounding areas for varying reasons. This research gives managers the opportunity to learn about the different needs of their visitors, and act accordingly to optimize the quality of their experiences on the forest.

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An Expanded Perspective on Displacement: A Longitudinal Study of Visitors to Two Wildernesses in the Cascade Mountains of Oregon

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Abstract—Displacement has traditionally been defined as a process in which visitors cease using a recreation site because of sensitivity to crowding or other impacts. This study argues that such a definition is overly narrow: Displacement may also occur when those sensitive to regulation cease using a resource. Evidence for the two types of displacement was collected through self-administered surveys at three Oregon wilderness trailheads in 1991 and 1997. At two areas, use levels and impacts were high in both study periods. At the third, use limits were imposed in 1995, reducing the number of encounters but increasing regimentation. Data from both years on perceptions of crowding and other impacts, support for use limits and visitation patterns provide little evidence that crowding-sensitive users were displaced from high-use destinations. There was substantial evidence that regulation-sensitive users were displaced by the new use limit system. These findings suggest that displacement of those sensitive to crowding may be less common than supposed, while displacement of visitors sensitive to regulation may be more common than previously believed. In high-use areas, some form of displacement is inevitable, and managers must clearly consider and justify which type of user they will displace.

Displacement has been defined as a process in which people move away from places that are changing in ways that they consider unacceptable (Becker 1981). It first became a topic in leisure discussions when researchers (Dustin and McAvoy 1982; Schreyer and Knopf 1984, for example) voiced concerns that high quality experiences dependent on low-density recreation use and concomitant low levels of impact might be endangered by the increasing use levels seen across wildernesses and wild rivers in the 1960s and '70s. These authors feared the homogenization of recreation experiences and advocated maintaining a full range of opportunities to better meet the needs of all citizens. In particular, they were afraid that as managers tried to meet the desires of the less discriminating multitudes by providing amenities and catering to growing numbers, users who sought solitude, self-reliance and low levels of development would be pushed from traditional and preferred sites, and left with nowhere to go. Some argued that, in wilderness, the needs and desires of those seeking solitude or experiences most consistent with the Wilderness Act of 1964 (labeled "purists" by some) should be given highest priority (Hendee and others 1968).

This argument has had a significant influence on the practice of wilderness management. Most managers today agree that wilderness serves as an important refuge for increasingly difficult-to-find opportunities for solitude and primitive settings. Thus, they have implemented policies and actions to maintain low levels of use, even when there is little support for this among the general public. This approach was recently given national publicity when managers of the popular Alpine Lakes Wilderness in Washington encountered organized opposition to their proposals to restrict use in order to provide more outstanding opportunities for solitude.

Before endorsing a management approach that seeks to minimize displacement of "purists" seeking experiences most consistent with the ideal described in the Wilderness Act, we feel that two questions should be answered. First, is there empirical evidence that crowding- and impact-sensitive users are displaced by high levels of use, and how substantial is this displacement? Second, is displacement of "wilderness purists" the only, or even the most common, type of displacement? What about users who may be "displaced" by actions taken to maintain resources for the benefit of purists? Although the term displacement has typically been confined to visitors who seek solitude and can no longer find it, there are other types of people, with different needs and desires, who may also be displaced. Perhaps some users value freedom and lack of regulation more than solitude and would be displaced by the imposition of use limits or other regulations. Because these people are affected differently by different courses of action (or inaction), managers need to be aware of their presence and views.

Empirical Evidence of Displacement

Most people probably agree at an intuitive level that displacement of crowding-sensitive users occurs when use levels increase. However, because the techniques typically employed in studies (cross-sectional studies of current visitors) are often insufficient to detect displacement, empirical evidence is rare and inconsistent. For example, panel studies (such as Kuentzel and Heberlein 1992; Shindler 1993) have tended to find that cessation of use is poorly correlated

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with perceptions of crowding at the time of initial inquiry. Instead, cessation of use is usually the result of lifestyle changes or changing interests. In other studies (Anderson and Brown 1984, for example), changes in use are inferred to be caused by increasing use, without verification of this assumption by survey respondents. In such cases, other unexplored explanations, such as a desire to explore new areas or increasing skill levels, might better account for changing use patterns. Nevertheless, some studies have found that some visitors sensitive to crowding (or, sometimes, sensitive to resource degradation) use sites less than in the past (Vaske and others 1980) and/or shift to new areas (Shelby and others 1988).

No studies have been undertaken of displacement of those sensitive to regulations. Obviously, many visitors are turned away (displaced) if demand exceeds the limited number of permits, but it is not known how many choose not to apply (and are displaced) simply because of the new regulatory system itself.

Definitions: Two "Types" of Displacement

Our research questions deal with the existence and magnitude of two types of displacement. For purposes of discussion, we define Type 1 displacement as that which occurs because a wilderness is heavily used and impacted. In these areas, visitors who care most about solitude and low levels of impact will presumably be displaced, leaving visitors who are relatively less sensitive to impacts. Visitors who care more about lack of regulation than about solitude should continue to use these sites. We define Type 2 displacement as that which occurs because wilderness is highly regulated. Type 2 displacement will result in the displacement of those who care more about freedom and lack of regulation than about solitude. Visitors who care enough about solitude (and/or low levels of impact) to obtain a limited permit should continue to use or be attracted to the site. We believe that both forms of displacement are likely to occur and that displacement is a constant process, resulting from both management action and inaction.

Study Areas

We conducted longitudinal research (cross-sectional studies of current visitors in 1991 and 1997) at three high-use trailheads in two wildernesses in the Cascades Mountains of Oregon. In 1991, Obsidian Falls trail received approximately 2,970 visitors, who hiked through several miles of montane forest to reach scenic subalpine meadows. Nearly half of this use was by overnight visitors. Green Lakes trailhead provides a shorter trail into an open, spectacular set of lakes. The trailhead is just 30 miles from Bend, Oregon. This is the most heavily used part of Three Sisters Wilderness, with 6,045 visitors in 1991. Marion Lake, in the Mt. Jefferson Wilderness, differs from the other two sites in being entirely forested. It is a popular, easy overnight destination and receives heavy use by anglers. There were approximately 4,300 visitors to Marion Lake in 1991.

Research conducted in 1991 and 1992 indicated that the number of encounters between groups at all three locations exceeded Forest Plan standards, which called for an 80% chance of seeing 10 or fewer groups in a day (Hall and Shelby 1993). During a typical eight-hour summer day, a visitor would meet an average of about 22 groups at Green Lakes, 14 at Obsidian Falls, and 13 at Marion Lake. As a result of these high encounter rates, managers considered a variety of remedies, ranging from education to use limits. After much public involvement and deliberation, in 1995 they opted to impose use restrictions at Obsidian Falls but not the other two locations.

In 1997, the Obsidian Falls permit system limited use to 20 groups entering the trailhead per day. There was no ceiling on the number of people who could visit, only the number of groups. Visitors were required to obtain a permit at one of two ranger stations, under a first-come, first-served system for both day and overnight users. The regulation was enforced by wilderness ranger patrols and a trailhead host, who spent the first two years in a primarily educational mode. In 1997, enforcement increased, and those without permits were turned away.

Thus, our study examined visitors to three sites that had high levels of use in 1991, two of which continued unregulated and one of which experienced new restrictions. Our objectives were to search for evidence of Type 1 displacement at Green Lakes and Marion Lake and of Type 2 displacement at Obsidian Falls. We also attempted to assess the relative magnitude of each type of displacement. Data were initially collected for other purposes than this study, and survey questions did not specifically target displacement. Despite this limitation, the data do provide a unique opportunity to address important questions of displacement.

Hypotheses

Hypothesis 1 revolves around the changes we would expect between 1991 and 1997 visitors to Green Lakes and Marion Lake if purists were displaced by continued high use. Over time, the composition of users should come to be made up of more impact-tolerant users. Although those who are not sensitive to impacts should continue to use the site as before, any purists who continue to use the site should report using it less over time, and therefore the overall sample of respondents should report using the site less. Use levels may rise at these sites because of an influx of new visitors; combined with the displacement of purists, this means that overall experience levels with the site should decline. Our specific hypotheses that, if confirmed, would provide evidence of Type 1 displacement at Marion and Green Lakes were:

- H1a: There should be a decline between 1991 and 1997 in perceived crowding, holding encounters constant.
- H1b: There should be a decline between 1991 and 1997 in the proportion of visitors reporting that ecological impacts detract from their experience.
- H1c: There should be a decline between 1991 and 1997 in the proportion of visitors who support restrictive management actions, specifically use limits.
- H1d: Visitors in 1997 should report that they come to these areas less often than in the past.
- H1e: The mean number of previous visits to the study sites should decrease.
- H1f: The proportion of first-time visitors should increase.

H1g: Assuming that wilderness "purists" are more experienced generally in wilderness, as has been found in several studies (Manning 1986), the level of overall wilderness experience should decline.

We hypothesized that, if Type 2 displacement occurred between 1991 and 1997 at Obsidian Falls, 1997 visitors would be more tolerant of regulation than 1991 visitors. Obsidian Falls might also appear more attractive to purists in 1997 than 1991, because the new use limits would ensure more solitude. Compared to 1991 respondents then, 1997 users of this site should appear more sensitive to crowding and other impacts. In this case, existing (experienced) users may be displaced by regulation, whereas purists who had formerly avoided the site might begin to visit. Those earlier visitors who still come to the site may come less often because of the regulatory changes. Overall, this means that site-specific experience levels would decline. Because those who oppose regulation are most likely to have been displaced, the 1997 population of visitors should be made up of more regulation-tolerant people than visited in 1991. The specifics of Hypothesis 2 for changes among Obsidian Falls visitors were:

H2a: There should be an increase from 1991 and 1997 in perceived crowding, holding encounters constant.
H2b: There should be an increase from 1991 and 1997 in the proportion of visitors reporting that ecological impacts detract from their experience.
H2c: There should be an increase from 1991 and 1997 in the proportion of visitors who are supportive of restrictive management actions, specifically use limits.
H2d: Visitors in 1997 who had been visiting since before the regulations took effect should report that they come to this area less often than in the past.
H2e: The mean number of previous visits to the study site should decrease.
H2f: The proportion of first-time visitors should increase.
H2g: Assuming that wilderness "purists" are more experienced generally in wilderness, as has been found in several studies (Manning 1986), the level of overall wilderness experience should increase.

Our final questions concerned which type of displacement is more prevalent. Our null hypothesis was that both types would be equally likely. Thus,

H3a: The distribution of previous trips at all three areas in 1997 should be the same.
H3b: The change in number of first-time visitors, between 1991 and 1997, and the number of first-time visitors in 1997 should be equivalent at all three areas.
H3c: The number of study variables (visitor characteristics and opinions) showing statistically significant changes over time should be the same at all three areas, assuming that such changes indicate a change in users.

Methods

Survey Administration

In 1991, data were collected at the three trailheads using a four-page written questionnaire administered on randomly sampled days (approximately 10 weekend days and 15 weekdays). All groups exiting the wilderness were approached, and all members were asked to complete the survey. The same strategy was employed in 1997. Response rates ranged from 67 to 79 percent in 1991 (n's 315 to 452) and from 61 to 85 percent in 1997 (n's 155 to 356).

Analysis

Changes between years were assessed using t-tests for continuous data and chi-square tests for nominal and ordinal data. For t-tests, one-tailed tests were used where hypotheses predicted a directional difference. In tables, one-tailed p-values are reported where differences were in the direction suggested by hypotheses; otherwise, two-tailed values are reported.

Results

Because they make reference to the same set of variables, we present evidence for Type 1 and Type 2 displacement together. Our hypotheses predict different results for some variables at the different study areas. Note that any lack of evidence does not mean that displacement did not occur; we just did not find evidence that it had with our methods. We describe results for H3 separately.

Sensitivity to Crowding and Encounters

To evaluate H1a and H2a, we asked respondents to report how many other groups they met on the day we contacted them (encounters), as well as how crowded they felt (nine-point scale). For different numbers of encounters, we computed the proportion of visitors who felt that encounters detracted from their experience (table 1), as well as the linear relationship between number of encounters and sense of crowding (figure 1). There were no statistically significant changes at any of the areas in the proportion of visitors saying encounters detracted from their experience. Results of the regression analysis that modeled crowding as a function of encounters and year indicated no significant change

Table 1—Percent of respondents who felt that encounters detracted from experience, 1991 versus 1997.

	Number of groups encountered		
	0-5	**6-10**	**>10**
Green Lakes			
1991	25	23	42
1997	15	19	40
p[a]	.29	.21	.69
Marion Lake			
1991	15	12	43
1997	6	8	33
p[a]	.13	.70	.43
Obsidian Falls			
1991	20	41	55
1997	23	40	30
p[a]	.90	.99	.29

[a]Chi-square test.

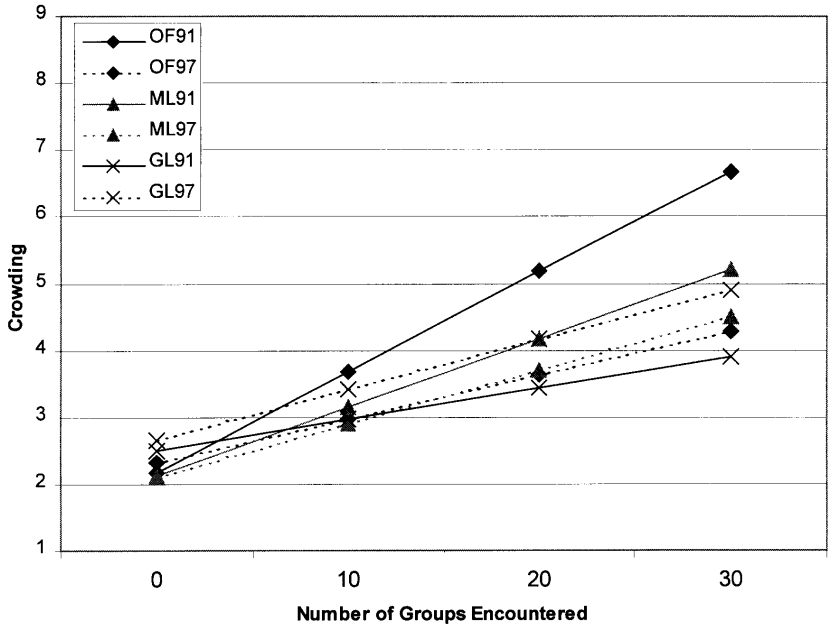

Figure 1—Relationship between encounters and crowding. (Note: difference in slope of regression lines 1991 to 1997: p = .023 Green Lakes; p = .43 Marion Lake; p = .14 Obsidian Falls.)

between years for Marion Lake and Obsidian Falls. There was a significant difference at Green Lakes, but in the direction counter to our hypothesis. Thus, there is no support for H1a or H2a, and therefore no evidence of either Type 1 or Type 2 displacement.

Despite the lack of evidence for H1a and H2a, additional data available from 1997 visitors suggest that Obsidian Falls visitors may be somewhat more sensitive to encounters. Respondents were asked to indicate the maximum number of encounters they would accept in a day in wilderness, if they knew their responses might be used to establish use limits. They could select one of three answers:

- encounters don't matter to me
- encounters matter, but I can't give a specific number
- the maximum acceptable number of groups to meet in a day is _____

The data suggest that, in 1997, Obsidian Falls attracted visitors who were somewhat more sensitive to encounters than users of Marion and Green Lakes (table 2). Fifty-one percent of 1997 Obsidian Falls visitors, but only 29 percent of Marion Lake visitors and 32 percent of Green Lakes visitors, have a personal standard for encounters. These data are consistent with the hypothesis, but because we do not have comparable data from 1991, we cannot be certain that other factors are not responsible for the observed differences. However, although Obsidian Falls visitors are more likely to consider the number of encounters relevant to their experience, those who have personal standards for encounters do not differ in their evaluations of what is acceptable. Among those with personal standards, visitors to all three areas believe that around 10-15 encounters per day is the maximum acceptable for wilderness.

Table 2—Personal standards for encounters in wilderness, 1997 visitors.

	Obsidian	Marion	Green
	- - - - - - -	*Percent* - - - - - -	
Encounters don't matter	18	29	37
Encounters matter, but can't give a number	31	42	31
Give a number	51	29	32
Mean—Maximum acceptable number of encounters	11.7	10.7	15.5

Sensitivity to Ecological Impacts

To test H1b and H2b, we asked visitors to report whether a variety of physical and ecological impacts from recreation detracted from their experience. They could indicate that they had not noticed an impact or that noticing detracted a lot, a little or not at all. Among those who noticed impacts, there were few significant changes between 1991 and 1997 in the proportion who said impacts detracted from their experience (table 3). Hypothesis 1b was partially supported: Sensitivity to one or three of the eight impacts decreased significantly at Marion and Green Lakes, while there were no significant increases at either of the two locations. This provides some evidence consistent with our expectations for Type 1 displacement. However, our prediction that sensitivity would increase among Obsidian Falls visitors (H2b) was not supported. In fact, for two of the types of impact, visitors displayed a reduction in sensitivity. It is possible that these responses reflect a reduction in impact levels resulting from more intensive management actions in recent years.

Table 3—Percent of respondents who noticed ecological impacts that felt they detracted from the experience, 1997 versus 1991.

	Green Lakes			Marion Lake			Obsidian Falls		
	1991	1997	*p*[a]	1991	1997	*p*[a]	1991	1997	*p*[a]
	- - - - *Percent* - -			- - - *Percent* - -			- - - *Percent* - - -		
Trails worn or too wide	49	51	.51	50	47	.58	57	52	.51
Many side trails	64	50	.004	61	53	.18	65	57	.26
Vegetation loss at campsites	76	59	.002	73	70	.57	79	65	.02
Tree damage	63	44	.005	80	66	.01	71	62	.27
Erosion of shorelines	75	64	.11	63	65	.89	77	73	.70
Litter	75	66	.23	86	80	.17	77	71	.40
Human waste	56	42	.28	67	68	1.00	67	33	.01
Horse manure	73	77	.15	75	72	.46	75	68	.12

[a]Chi-square test.

Table 4—Opinions about the need for use limits.

	Limit use now	Do not limit use now	*p*[a]
	- - - - - - - *Percent* - - - - - -		
Green Lakes			
1991	37	63	
1997	28	72	.006[a]
Marion Lake			
1991	22	78	
1997	27	73	.12
Obsidian Falls			
1991	40	60	
1997	59	41	<.0005

[a]Chi-square test.

Support for Use Limits

Hypotheses 1c and 2c concern support for restrictive management policies. To evaluate these hypotheses, we asked visitors whether they felt restrictions were needed on the number of people visiting the study areas. They could indicate that use should be limited now (either by reducing or capping use levels), that no limits are needed now but might be in the future, or that no limits should ever be imposed. We predicted (H2c) that Obsidian Falls users would show an increase in support for regulations between 1991 and 1997, because regulation-sensitive users would have been displaced, while Green Lakes and Marion Lake users would show an even lower level of support for regulation (H1c). In 1991, use limits were not supported by a majority of visitors in any of the three areas (table 4). In 1997, use limits were still not supported at Green or Marion Lakes, but a majority did support them at Obsidian Falls, where they had been implemented. Thus, Hypothesis 2 was supported, and Hypothesis 1 was supported at Green Lakes but not Marion Lake.

Further evidence of support for limits is available from a question presented to Obsidian Falls users in 1997. The majority of these visitors said that limits should be continued. About 75 percent of visitors supported continuing limits, even though in 1991, 60 percent had said that no use limit system was needed at that time. When asked how the limits affected their enjoyment, 68 percent of day and 57 percent of overnight respondents said the permit system enhanced their experience, while only 29 percent of day and 26 percent of overnight visitors said it detracted. The remainder said it had no effect on their experience. These data are consistent with H2, which predicts displacement of regulation-sensitive users. However, it is also possible that they reflect a change in the opinions of visitors when they are actually exposed to use limits.

Experience With This Place

Several questions asked about visitors' past use of the study area. First, we asked respondents to tell us how they had changed their use of the study site since 1991. Only those who had been coming to the site before that time responded to this question. Most people at each area said their use of the area had not changed (table 5). At Obsidian Falls, however, users were three times as likely to say they visited less than in the past than to say they visited more. At Green Lakes and Marion Lake, equal proportions of users gave each of these responses. This is consistent with H2d but not H1d, providing evidence of Type 2 displacement but not Type 1. It is not possible to know whether Obsidian Falls users visited less because they could not get a permit or because the system itself deterred them from trying. Information from the Forest Service indicated that not all permits were used (weekday slots were often available), so it is possible that many long-term visitors were displaced by the regulatory regime.

The mean number of past trips to the study sites decreased dramatically between 1991 and 1997 at Obsidian Falls, supporting H2e and providing evidence of Type 2 displacement (table 6). The only support for H1e, that the mean number of previous trips would decline at Marion and Green Lakes, came from changes in day users at Marion Lake.

Table 5—Self-reported changes in use of the study trail between 1991 and 1997.

	Green (*n* = 68)	Marion (*n* = 90)	Obsidian (*n* = 25)
	- - - - - - - - - *Percent* - - - - - - - - - -		
Use more than in past	19	20	12
Use same as in past	62	59	52
Use less than in past	18	21	36

Chi square test, $p = .02$.

Table 6—Mean number of previous trips to study site.

	Length of stay	1991	1997	p^a
Green Lakes	Day	2.7	3.1	.44
	Overnight	2.7	2.0	.15
Marion Lake	Day	12.0	4.1	.005
	Overnight	4.1	8.2	.09
Obsidian Falls	Day	5.5	1.4	.003
	Overnight	2.7	1.5	.02

[a]T-test (one-tailed probability).

More evidence for Type 2 displacement comes in testing H2f. The proportion of first-time visitors increased markedly at Obsidian Falls (table 7). However, the proportion of first-time visitors did not increase at Green or Marion Lakes. Once again, the evidence for Type 1 displacement is lacking.

General Wilderness Experience

A number of studies, reviewed in Manning (1986), report that wilderness purists tend to have more general experience in wilderness than those more tolerant of impacts and encounters. Therefore, if both types of displacement are occurring, we would expect experience levels to decline at Green and Marion Lakes (H1g) and increase at Obsidian Falls (H2g). Specifically, we asked questions about the mean number of other wildernesses visited by respondents and their frequency of trips to wilderness, in 1991 and 1997. We found no support for either hypothesis. The only statistically significant change was an increase in the experience of day users at Green Lakes, a result counter to expectations (table 8).

Which Displacement Type Was More Pronounced?

Our third hypothesis was built around the expectation that the extent of displacement could be assessed through examination of changes in several variables. We consider displacement to be most pronounced in the place where 1) prior experience with that place decreased most, 2) the number of first-time visitors increased most and 3) more visitor characteristics changed significantly. Any of these findings would suggest that there has been a greater turnover in the people who visit the area. From table 6, it is clear that the mean number of previous trips to the study site decreased substantially at Obsidian Falls: 75 percent for day visitors and 44 percent for overnight visitors. There were no significant decreases at Green Lakes. Contrary to expectations, the number of previous trips by Marion Lake overnight users increased, although not enough to be statistically significant. Number of previous trips by day users at Marion Lake decreased significantly, consistent with displacement, but still was higher in 1997 than at the other two places. In 1997, mean number of previous trips was lower at Obsidian Falls than at the other two areas. Therefore, we reject the null hypothesis H3a and suggest that Type 2 displacement may have been more pronounced than Type 1 displacement in these areas.

The proportion of visitors on their first visit to the study site increased dramatically at Obsidian Falls (table 7). There were 85 percent and 32 percent increases in the proportion of day and overnight visitors, respectively, taking their first visit to Obsidian Falls. In contrast, there were no substantial increases in first-time visitors at Green or Marion Lakes. Moreover, in 1997, first-time visitors were much more prevalent at Obsidian Falls than at the other two areas, despite the fact that, in 1991, first-time visitors were least prevalent at Obsidian Falls. Null H3b is rejected, providing further evidence that Type 2 displacement has been more pronounced than Type 1 displacement. Particularly among day users, Obsidian Falls visitors have shifted from being experienced repeat visitors to the area to primarily first-time visitors.

There is also some evidence that 1997 visitors were more different from 1991 visitors at Obsidian Falls than at the other areas. As previously described, the magnitude of changes in opinions about use limits and previous use of the study site were highest at Obsidian Falls. Other data we collected (not presented), indicate that the proportion of overnight visitors staying out one night, rather than more nights, increased much more at Obsidian Falls than elsewhere. The average group size of overnight groups also increased much more at Obsidian Falls than elsewhere. No visitor characteristic variables changed substantially more at Green and Marion Lakes than at Obsidian Falls. This provides admittedly limited evidence that null H3c should be rejected and that Type 2 displacement is more pronounced than Type 1 displacement. If we had included a wider range of sociodemographic variables on the questionnaire, we would have been in a stronger position to evaluate this hypothesis.

Table 7—Percent of respondents on first trip to study site.

	Length of stay	1991	1997	p^a
Green Lakes	Day	48	49	.77
	Overnight	51	53	.81
Marion Lake	Day	42	48	.36
	Overnight	38	35	.53
Obsidian Falls	Day	33	61	.001
	Overnight	44	58	.04

[a]Chi-square test.

Table 8—Mean number of other wilderness areas visited.

	Length of stay	1991	1997	p^a
Green Lakes	Day	10.5	14.9	.002
	Overnight	9.7	10.1	.79
Marion Lake	Day	13.5	11.8	.25
	Overnight	6.7	8.8	.18
Obsidian Falls	Day	11.1	8.5	.17
	Overnight	10.0	13.7	.10

[a]T-test (one-tailed probability).

Discussion

At Green and Marion Lakes, we found very little evidence of Type 1 displacement, the traditional type in which visitors sensitive to crowding and impacts are displaced by increasing use and managerial inaction. Evidence we had expected to find included 1) decreased sensitivity to crowding, 2) decreased sensitivity to ecological impacts, 3) decreased support for regulation (specifically use limits), and 4) decreased experience both with the specific study site and with wilderness in general. The only evidence we found was decrease in support for use limits (but only at Green Lakes), a decrease in number of previous trips to the study site (but only among Marion Lake day users) and a decrease in the proportion of visitors who stated that some types of ecological impacts adversely affected their experience. However, it is possible that the latter finding resulted from a decrease in impact levels rather than a reduced sensitivity to impacts. For example, between 1991 and 1997, managers implemented campfire restrictions, a designated campsite program and site restoration at Green Lakes.

Despite this lack of strong evidence for Type 1 displacement, we must acknowledge that other measures might have uncovered stronger evidence of displacement. Thus, our negative findings do not "prove" that Type 1 displacement did not occur. More important, our study only looked for evidence of displacement between 1991 and 1997. Green and Marion Lakes were both heavily used in 1991 and substantial displacement may have occurred before then.

In contrast, we found strong evidence for Type 2 displacement at Obsidian Falls, where use limits were established between 1991 and 1997. This type of displacement is the previously ignored type, in which users sensitive to regulation and/or unwilling or unable to obtain a permit are displaced by regulation. Evidence we had expected to find included 1) increased sensitivity to crowding, 2) increased sensitivity to ecological impacts, 3) increased support for regulation, and 4) decreased experience at the specific study site but increased experience with wilderness in general. Consistent with expectations, at Obsidian Falls we found dramatic increases in support for regulations and decreases in prior use of the study site. Most visitors were first-time users and many long-term users visit the area less often than in the past. However, we did not find increases in sensitivity to crowding or to ecological impacts or increases in overall wilderness experience.

In addition to finding more evidence of Type 2 displacement than of Type 1, the magnitude of Type 2 displacement appears to have been much greater than Type 1. Between 1991 and 1997, many more people appear to have been displaced from Obsidian Falls by use limits than were displaced from Green and Marion Lakes by increasing use and/or deteriorating conditions resulting from lack of restriction.

Two potential reasons for these findings that we have already mentioned are 1) that our methods were inadequate to find evidence of Type 1 displacement and 2) that we looked for evidence of Type 1 displacement after it had already occurred. A third possibility is that Type 2 displacement is more pronounced than Type 1 displacement because more visitors care more about regulations than about crowding or impacts. This is consistent with our finding that current Obsidian Falls visitors are better characterized by their acceptance of regulation than by an increased sensitivity to crowding and impacts. It is underscored by our finding that Obsidian Falls visitors are more likely than visitors to Green or Marion Lakes to say that the number of people they encounter affects their experience, but they do not differ in their evaluation of how many encounters are acceptable (table 2). That is, Obsidian Falls visitors appear more aware that encounters are an issue and perhaps are more tolerant of restriction as a result. But these more aware users are not more sensitive to a given number of encounters or impacts and, therefore, probably should not be considered "purists."

Management Implications

We suggest that the traditional definition of the displacement concept – a process in which recreationists are driven away from a preferred place due to conditions becoming too crowded and/or impacted – is overly narrow and has focused on meeting the needs of one segment of the visitor public while ignoring how other segments might be affected. Consequently, managers and researchers have typically judged displacement as inherently bad and something in need of redress. We suggest that displacement should be given a more generic, balanced definition, as a process in which recreationists are driven away from a preferred place due to changes in conditions resulting from management action or lack thereof. Using this definition, it is clear that displacement must be a constant and inevitable process anywhere use/impact levels are high or increasing or where restrictive management actions have been taken. In our study area, over the six-year time frame we examined, displacement as a result of increased restriction (at Obsidian Falls) was more pronounced than the displacement of visitors as a result of increased crowding/impact (at Green Lakes and Marion Lake).

Considering displacement from this broader perspective should caution managers not to think of one form as necessarily better or worse than another. In the types of settings we have described, some visitors will be displaced, regardless of what managers do or fail to do. In this context, the question is whether the group that is being driven away is the group that managers want to drive away. It is no longer a question of how to solve the "problem" of displacement once and for all. Managers must make a subjective judgement about the conditions they want to provide (for example, low density-highly restrictive or higher density-unconfined) and which clientele they will favor (purists or nonpurists, regulation-tolerant or regulation-averse). Managers who do not confront this question directly are still favoring one group or another because even inaction will result in displacement.

Managers must make these subjective judgements based on a thorough analysis of regional supply and demand for different recreational opportunities, along with consideration of natural resource preservation needs. Managing displacement entails considering where people go, and where they can find the experiences they desire. This should draw managers' attention to regional issues, something that is rarely done. Surveys of current visitors at individual sites are of little utility in this regard because current visitors almost inevitably support the existing management regime.

For example, most visitors to all three of our study areas felt, in 1991, that use levels should not be capped or reduced at that time. In 1997, this remained the opinion of visitors at Green Lakes and Marion Lake, where use remained unlimited. However, most of the 1997 visitors to Obsidian Falls (mostly first-time visitors) supported the use-limitation program that had been implemented. Without replication over time, we would have been unable to detect this change and would have concluded, as usually is done, that current visitors are satisfied with conditions and management.

The possibility that regulation is more relevant and important to visitors than solitude and impacts is an intriguing thought. Perhaps the imposition of regulations favors a regulation-tolerant clientele rather than purists and displaces purists as well as those intolerant of regulation. More pleasant to consider is the possibility that the restrictions implemented at Obsidian Falls simply were not restrictive enough and did not create enough improvement to appeal to purists. This would be consistent with evidence that use levels must be reduced to very low levels before any significant improvement in conditions is possible (Cole and others 1997).

Our data do not allow us to judge among these various possibilities. All we can conclude is that the major change at our study sites, between 1991 and 1997 when use limits were established at Obsidian Falls, was displacement of many visitors from Obsidian Falls. These users were replaced by visitors better characterized as regulation-tolerant than as purist or sensitive to such wilderness attributes as solitude and natural conditions. Conventional wisdom that purists will be favored by use limits and that visitors will adapt to use limits may be overgeneralizations. In our study, we found little evidence of changes in the prevalence of purist sentiments, even where use limits were implemented. We also found that some visitors do adapt to use limits, but many others do not and are displaced or discouraged from visiting.

Although some crowding-sensitive users undoubtedly avoid high-use destinations, this tendency was not widespread in our study. Instead, it seems likely that crowding-sensitive visitors go to low-use areas when seeking solitude; they still may enjoy these unique, high-use destinations for different experiences. They may also come to these sites at different times, without avoiding them altogether. This conclusion is consistent with other research we have conducted on displacement at a high-use developed recreation setting (Hall and Shelby 1999). There, a large percentage of visitors said they adjusted to high-use conditions by visiting at different times of the year or week. Although this is a form of displacement (temporal), these users are not completely shut out from their desired resource, as the traditional displacement hypothesis sometimes suggests.

The displacement concept was originally advanced as an *explanation* for the poor correlation between use density/crowding and satisfaction/experience quality. This explanation has inherent appeal and is probably valid. In crowded places, those who are highly sensitive to crowding may be displaced to less crowded places or times, so the remaining visitors (the population captured in surveys) lack the highly sensitive visitors for whom a correlation between density and satisfaction should be most pronounced. However, once advanced as an explanation, displacement became described as a *process*, which typically has been considered to be inherently undesirable. We feel this is inappropriate because visitors are only considered displaced if increased crowding/impacts drove them away. Visitors should also be considered displaced if a place has become too lonely for their taste, if trails have disappeared, if use limits have forced them to go elsewhere, or if a restrictive management regime has driven them away. Moreover, referring to traditional displacement as inherently bad interjects the value judgement that visitors who need uncrowded conditions should be preferred over those who need unrestricted, free and spontaneous recreation opportunities. It may be appropriate to take actions that would maintain low-density recreation opportunities, particularly in wilderness. However, it is important to make this decision explicit, to recognize that the basis for this decision is subjective (not based on objective science) and that it will favor one group of visitors (wilderness purists) and displace others (those visitors who desire unrestricted recreation opportunities).

This leads us to conclude by recommending that managers of high-use wilderness areas clearly state their objectives and the types of experiences they intend to provide. We can think of three fundamentally different choices managers can make. First, they may choose to minimize the total number of people who will be displaced by their management program. Our results suggest that this position would lead managers of high-use areas to continue a regime characterized by high use and low levels of regulation, because more people are displaced by use limits than by crowding. In some areas, this may be a desirable approach. However it is unlikely to be appropriate everywhere, particularly in more lightly used places.

Second, managers may choose to favor purists – those sensitive to crowding and impacts. We feel that this option is problematic in high-use areas, because the Wilderness Act calls for both solitude and primitive, unconfined recreation. That is, wilderness visitors should be able to enjoy both outstanding opportunities for solitude and freedom from restrictions. Our data suggest that it is impossible to achieve both objectives at high-use wilderness destinations. Moreover, radical reductions in use would be needed to precipitate enough change to make areas attractive to purists.

Finally, managers may choose to set different policies for different wildernesses, or parts of wildernesses, as advocated by planning frameworks such as ROS and LAC. In a regional context, this may mean minimizing Type 1 displacement in some areas and Type 2 displacement in others. High-use wildernesses need not all have identical policies, as tends to be the case today, when many wildernesses share the same indicators and standards for experience quality. The wildernesses in the Cascades Mountains offer a good case in point. In Oregon and Washington, all of the large snow-covered volcanic peaks are in federally designated wilderness. They could provide a wide range of opportunities for diverse user groups. If one consistent policy is used to govern all these wildernesses, one group will be favored in all areas, to the detriment of all other wilderness user groups.

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Visitors' Knowledge of Federal Wilderness: Implications for Wilderness User Research and Management

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Abstract—Earlier research using interviews of backcountry hikers in Shenandoah National Park raised concerns that visitors may not know much about federal wilderness. This lack of knowledge has implications for research on wilderness experience and for support for wilderness management policies. In this study, self-assessed knowledge of wilderness, researcher-assessed knowledge, and knowledge filter questions were tested for their effectiveness in classifying wilderness knowledge; relationships between knowledge and attitudes toward management were also explored. More than 90% of hikers assessed themselves as having little or no knowledge of wilderness, and a researcher-assessed knowledge question confirmed that very few hikers were knowledgeable about federally designated Wildernesses. Those with higher levels of knowledge tended to hold more "purist" views about management than those with less knowledge.

During interviews of backcountry and wilderness users in Shenandoah National Park (SNP) in the fall of 1997, it became obvious that Park visitors did not have a clear idea of what federally designated wilderness was and where it was located. When respondents were asked whether or not they had ever been to a federal wilderness, most (83%) answered affirmatively, but follow-up questions revealed that many respondents included national parks and nonwilderness areas. Only about 25% of the park visitors interviewed appeared to be truly knowledgeable about whether or not they had been to a federal wilderness area before.

This issue concerned us, because we felt that managers and researchers often assume that visitors share their highly developed comprehension of wilderness. Nearly all wilderness user studies ask questions about past use of wilderness, appropriate conditions in wilderness, or support for wilderness actions or policies. When questions ask specifically and only about the site where visitors are contacted, it may not matter that many do not know where wildernesses are or how they are managed. But when questions ask about generic "wilderness," it may matter a great deal. We have little idea of whether respondents' answers are based on a clear conception of wilderness or whether they are answering about their local state parks (or other areas), which they incorrectly believe to be wilderness.

Reviewing numerous wilderness visitor studies, we could find very few that asked a filter question about knowledge before they begin detailed questions about past use of wilderness, support for wilderness management policies or other issues. Almost none provided information about the National Wilderness Preservation System (NWPS) to respondents. If respondents and researchers have very different conceptions of what wilderness is and where it is located, inferences made from the results of these types of questions may be incorrect.

Such concerns led us to study the issue in more depth. To more clearly understand the wilderness experience levels and knowledge of Shenandoah backcountry visitors, we included several questions during research in 1998. We were interested in two questions. First, do SNP hikers know what federally classified wilderness is? We approached this issue using a self-report and a single objective measure. Second, do hikers who know more about federally classified wilderness differ in their opinions about wilderness management issues from hikers who know little or nothing?

Methods

Study Area and Sample Population

This research was conducted in Shenandoah National Park (SNP). This park contains nearly 80,000 acres of federally designated wilderness, established in 1976. There is also a large amount of undeveloped backcountry not legally classified as wilderness. Due to its close proximity to the Washington, DC, area and the popularity of the nationally known Skyline Drive and Appalachian Trail, the SNP backcountry receives one of the highest backcountry and overnight use densities in the national park system. There were an estimated 1.7 million backcountry visitors in 1995 (Shenandoah National Park 1998). Our study population was defined as all adult visitors (•16 years) to SNP backcountry and wilderness areas between May 10 and October 31, 1998.

Survey Development

To address our two research questions, several items were included in a mail survey sent to visitors contacted at SNP during 1998 as part of a backcountry visitor survey conducted for the Park. Previous interviews with SNP visitors had indicated that although many visitors seemed

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certain that they had been to a wilderness area before, others seemed to realize their knowledge limitations. Typical responses were: "not knowingly;" "uh, probably, yeah;" and "yeah, I believe so." Others named a place they had been, but then followed up their response by asking the interviewer if that was a wilderness area. Therefore, one survey question in this study asked visitors to indicate how familiar they felt they were with the legal definition of wilderness (table 1). This question appeared in a section prefaced by the following statement. "Over the past 35 years, Congress has passed legislation creating a system of federally designated wilderness areas on public lands in the United States. We are interested in whether the legal definitions are consistent with visitors' ideas about what wilderness is and should be." The first questions (not reported here) asked about "your personal sense or definition of wilderness—what "wilderness" means to you," including items about best example and characteristics of wilderness. The question reported here followed those questions, and asked "How familiar are you with the legal definition of wilderness?" Because the majority answered, and because many gave responses showing they were uncertain, we believe visitors are able and willing to assess their own knowledge level.

Data from the self-assessment provided one measure of knowledge. As a check on its validity, respondents who said

Table 1—Survey questions addressing knowledge of wilderness.

How familiar are you with the legal definition of Wilderness?

- ☐ I have no idea—I didn't even know there was a land classification of "Wilderness."
- ☐ I have heard of Wilderness areas, but I don't know anything about the specific definition.
- ☐ I know a little bit about what legally classified Wilderness is.
- ☐ I think I know a lot about the legal definition of Wilderness.

Please list the three most recent wilderness areas (other than in Shenandoah) that you have visited.

_____

How often do you usually take wilderness trips? (Mark one.)

- ☐ I've never been to a wilderness.
- ☐ I don't know what wilderness is, so I don't know if I've been or not.
- ☐ Less than once every 2 years
- ☐ Less than once a year
- ☐ Once a year
- ☐ 2-5 times a year
- ☐ 6-10 times a year
- ☐ More than 10 times a year

The following is a list of policies that could be adopted for wilderness areas. Please indicate the extent to which you agree or disagree with each statement as a general policy for federal wildernesses in the United States. Please answer even if you are not sure about the legal definition of wilderness.

	Strongly agree	Agree	No opinion	Disagree	Strongly disagree
People should be allowed to carry cellular phones into the wilderness to use in case of an emergency.	+2	+1	0	–1	–2
People should not be allowed to carry cellular phones into the wilderness because technology detracts from the wilderness experience.	+2	+1	0	–1	–2
Trails in wilderness areas should be almost nonexistent, only blazed or marked routes.	+2	+1	0	–1	–2
Trails in wildernesses should be of varied type and quality in different places, to satisfy varied interests.	+2	+1	0	–1	–2
All wilderness trails should be improved and well-maintained.	+2	+1	0	–1	–2
There should be no trails, and no other human influence at all in wildernesses.	+2	+1	0	–1	–2
Moderate improvement of wilderness campsites is desirable (e.g., removing brush and limbs, putting nails in trees for utensils, simple box cupboards, etc.)	+2	+1	0	–1	–2
Lightning-caused fires in wilderness should be allowed to burn.	+2	+1	0	–1	–2
Places in wilderness denuded by fire, insects, or disease should be protected by replanting vegetation.	+2	+1	0	–1	–2
Heavy infestations of native insects in wilderness should be allowed to run their course.	+2	+1	0	–1	–2
Hunting should be forbidden in wilderness areas.	+2	+1	0	–1	–2
Wilderness managers should be allowed to use chainsaws to clear debris from wilderness trails.	+2	+1	0	–1	–2
Wildernesses should have few rules and regulations to ensure visitor freedom.	+2	+1	0	–1	–2
Mountain bikes should be allowed in wilderness areas.	+2	+1	0	–1	–2

that they had been to a wilderness before were asked to list the three most recent wilderness areas they had visited. (This question was in a section about "use of wilderness areas in the United States" and did not specify "legally classified." We believe that the prior questions about knowledge of legal wilderness probably cued respondents to be thinking of federal wilderness, but it is possible that they had a different idea in mind.) For analytic purposes, the areas respondents listed were sorted into three categories. If a respondent correctly listed federal wildernesses, and only federal wildernesses, they were classified as "knowledgeable." Those who listed no federal wilderness areas were classified as "unaware." Those who listed some wildernesses and some nonwilderness areas were classified as "mixed." In this process, we opted to code ambiguous areas generously. For example, "Mount Rainier"—which has both wilderness and nonwilderness—was coded as a wilderness, even though the respondent might not be thinking about the wilderness portion of the park when answering. However, *de facto* wilderness areas, such as the Yellowstone backcountry or the Grand Canyon, were coded as incorrect because they do not contain federally designated wilderness.

Another question asked about respondents' use of wilderness, using common categories for the frequency of trips. This question enabled us to discern how many respondents will answer such a question even if they themselves do not think they know what a wilderness is. (This item was in the same section as the previous question about most recent wilderness visits, and did not specifically instruct them to answer for "legally classified" wilderness.) We included a novel option in this question: "I don't know what wilderness is, so I don't know if I've ever been or not." We wondered if respondents who, in a prior question had indicated knowing nothing about wilderness, would select this option.

To test whether respondents with different levels of knowledge differed in their opinions on wilderness management, a set of 14 policy items was presented. Respondents were asked to indicate how much they personally agreed or disagreed with each item as a general policy for federal wildernesses in the United States, regardless of whether or not they were sure about the legal definition of wilderness.

Survey Administration

On randomly sampled days between May and October 1998, all visitors entering or exiting 23 sample trailheads were contacted and asked to complete a short contact sheet. In order to increase our sample of overnight users, visitors seeking backcountry camping permits at entrance stations and visitor centers were also asked to complete the short on-site survey during sample periods. Data were obtained for approximately 2,400 visitors (1,620 day and 782 overnight). Following the Dillman (1978) method, mail surveys were sent to those who had provided names and addresses (n = 1,660). After a postcard reminder and a second survey mailing, 856 usable surveys were returned, for a response rate of 51%.

Results

Self-Assessed Wilderness Knowledge

Responses to the self-assessment of knowledge revealed that the vast majority of users (>90%) believed that they knew at best only a little about what legally classified wilderness is (table 2). Most had only heard the term.

SNP visitors clearly do not feel they are very knowledgeable about federal wilderness, but this did not prevent them from answering the question about how often they usually take wilderness trips. Only 3% volunteered that they had never been to a wilderness area before, and in the filter response category only 10% said that they did not know what wilderness was, so they could not say whether or not they had been to one (table 3). Twenty percent indicated that they typically take more than six trips per year to wilderness areas. If people do not know what a wilderness area is and consider any state park or national park to be wilderness, this could be a gross overestimation of their actual number of trips to wilderness.

It is of particular concern that even those visitors who tell us that they know nothing about wilderness will answer such questions. Only 18% of this group selected the filter option we expected them to mark. Almost 75% reported some frequency of wilderness trips. Thus, we cannot expect those who do not understand the intent behind questions about wilderness to leave such items blank. This finding is consistent with a large body of public opinion research that has found that people will answer questions even about issues of which they have little or no knowledge (Bishop and others 1986; Hippler and Schwarz 1989; Schuman and Presser 1980).

Researcher-Assessed Knowledge

Self-reports are only one measure of knowledge. To further understand whether SNP hikers know what wilderness is, those who reported having made a wilderness trip in the previous question were asked to name the three most recent wilderness areas they had visited. As discussed previously, the responses were coded as knowledgeable (named only units of the NWPS), mixed (named at least one wilderness and one nonwilderness) and unaware (named only nonwilderness areas). It is important to note that the question

Table 2—Self-assessed knowledge of federal wilderness among SNP hikers.

Self-assessed wilderness knowledge	Percent
I have no idea—I didn't even know there was a land classification of "wilderness."	9.8
I have heard of Wilderness areas, but I don't know anything about the specific definition.	51.3
I know a little bit about what legally classified Wilderness is.	31.5
I think I know a lot about the legal definition of Wilderness.	7.4

Table 3—Frequency of wilderness visitation as reported by visitors with different self-assessed levels of wilderness knowledge.

Frequency of wilderness visitation	Self-assessed wilderness knowledge				
	Total	High	Little	Heard of	No idea
			-percent-		
I've never been to a wilderness.	3.4	0.0	2.4	3.0	9.6
I don't know what a wilderness is.	9.8	0.0	3.2	14.2	17.8
Less than 1 trip every 2 years.	7.5	0.0	4.0	9.7	12.3
Less than 1 trip every year.	5.4	5.1	6.4	4.7	4.1
1 trip per year.	16.5	13.6	20.1	14.7	19.2
2-5 trips per year.	36.9	35.6	40.6	36.8	24.7
6-10 trips per year.	11.1	28.8	12.1	8.7	6.9
More than 10 trips per year.	9.4	17.0	11.2	8.2	5.5

Chi-square test, $p < 0.0005$.

asked "about your use of wilderness areas in the United States" without specifically denoting units of the NWPS. Thus, some respondents may have reported based on their personal idea of what is wilderness. However, because an earlier question informed visitors that there is a federal system of wilderness, we believe this is what they had in mind when answering.

By this classification, only 13% of these respondents were judged knowledgeable (table 4). Forty-one percent responded by naming at least one wilderness area and one nonwilderness area, and 46% named only areas which were not wilderness. Generous classification of ambiguous cases (generally national parks) as wilderness means that these figures probably overestimate the number of people who actually visited federal wilderness areas.

Next, we explored the relationship between our classification and respondents' self-assessed level of knowledge. For analysis, respondents who indicated that they didn't know how many trips they had taken to wilderness because they didn't know what wilderness was (10% of respondents) were included in the "unaware" category.

There is a clear relationship between the two measures, particularly for those low in knowledge. Of some concern is the small percentage (25%) of those claiming high knowledge who accurately named wilderness areas (table 5). However, over 75% of this group named at least one wilderness area, which is much higher than the rate among visitors who indicated they had less knowledge. We classified only 3% of those with low self-assessed knowledge as knowledgeable. These data suggest that people who say they don't know what wilderness is in fact do not, but that a portion of those who say they know a lot do not appear to know as much as they think.

Table 4—Researcher-assessed knowledge of SNP visitors who reported taking a wilderness trip.

Researcher-assessed knowledge	Percent
Knowledgeable	13.2
Mixed	41.0
Unaware	45.8

Management Opinions

It is clear from the mail survey and interviews that most SNP hikers do not know which management units or locations are wilderness, but what does this mean? Are there management or research implications? To investigate this issue we used respondents' self-assessed knowledge levels to compare opinions about different management issues. We used the self-assessed knowledge instead of our classification because the two measures were highly correlated, and because coding was less problematic. (For example, many respondents named *de facto* wilderness areas—which may demonstrate their knowledge of the concepts behind the legal definition of wilderness—but were coded in our classification as nonwilderness.)

For all but two of 14 wilderness management policy items, those who are more knowledgeable about wilderness have different views about appropriate wilderness management than those who know little about wilderness (table 6). In several cases, the differences are quite pronounced. Interestingly, in every case, those who profess higher knowledge hold opinions that are most consistent with a "purist" orientation and the Wilderness Act. For example, they are least supportive of allowing cellular phones, chainsaws or improved campsites, and most supportive of allowing natural processes to operate or prohibiting mountain bikes in wilderness.

Discussion

Management Implications

We found that less than half of the people we contacted in Shenandoah National Park named a federal wilderness

Table 5—Relationship between self- and researcher-assessed knowledge of wilderness.

Researcher-assessed knowledge	Self-assessed knowledge classification			
	High	Little	Heard of	No idea
		-percent		
Knowledgeable	25.0	14.7	9.1	3.3
Mixed	51.8	43.8	30.1	31.2
Unaware	23.2	41.5	60.8	65.6

Chi-square test, $p < 0.0005$.

Table 6—Mean level of agreement with wilderness management policies.[1]

Wilderness management policies[2]	Self-assessed knowledge				
	High	Little	Heard of	No idea	*p*[3]
People should be allowed to carry cellular phones for an emergency.	0.3[a]	0.7[b]	1.0[c]	1.2[c]	0.000
People should not allowed to carry cellular phones because technology detracts from the wilderness experience.	–0.2[a]	–0.6[b]	–0.9[bc]	–1.0[c]	0.000
Wilderness trails should be almost nonexistent.	0.3[a]	0.3[a]	0.0[a]	–0.5[b]	0.000
Trails should be of varied type and quality in different places to satisfy varied interests.	0.3[a]	0.7[b]	1.0[c]	1.3[c]	0.000
All wilderness trails should be improved and well-maintained.	–0.8[a]	–0.5[a]	–0.2[b]	0.2[c]	0.000
There should be no trails, and no other human influence at all in wilderness.	–0.4[a]	–0.7[b]	–0.9[b]	–0.9[b]	0.001
Moderate improvement of wilderness campsites is desirable.	–0.9	–0.6[ab]	–0.3[bc]	–0.1[c]	0.000
Lightning-caused fires should be allowed to burn.	0.7[a]	0.4[b]	0.0[c]	0.0[c]	0.000
Places denudes by fire or insects should be protected by replanting vegetation.	–0.6[a]	0.0[b]	0.2[b]	0.2[b]	0.000
Heavy infestations of insects should be allowed to run their course.	0.6[a]	0.4[ab]	0.2[b]	0.2[b]	0.034
Hunting should be forbidden in wilderness.	0.8[a]	0.9[a]	0.7[a]	1.0[a]	0.123
Managers should be allowed to use chainsaws to clear debris from wilderness trails.	0.1[a]	0.5[b]	0.7[bc]	0.9[c]	0.000
Wildernesses should have few rules and regulations to ensure visitor freedom.	–0.4[a]	–0.6[a]	–0.6[a]	–0.4[a]	0.419
Mountain bikes should be allowed in wilderness areas.	–1.0[a]	–0.8[ab]	–0.5[b]	–0.5[b]	0.001

[1]Scale +2 = strongly agree, –2 = strongly disagree.
[2]Complete wording of items is found in table 1.
[3]ANOVA, Duncan's *post hoc* comparisons. Values with different superscripts are significantly different at the .05 level.

when asked to report wildernesses they had visited. We believe this means that many do not know where federal wilderness is. (However, our question wording was not as precise as desirable to be fully confident of this conclusion; some people may not have been clear that this question asked specifically about federally classified wilderness.) The indication that a relatively large percentage of people do not know whether they have been to a wilderness area has implications concerning the many wilderness studies that ask about past wilderness experience. Our findings suggest that results from such questions may not validly measure the constructs researchers intend them to measure: Respondents may be including a wide range of areas when describing past experience. Managers might conclude that their visitors are experienced, and therefore knowledgeable about policy, behavior or regulations, when in fact they are not.

Furthermore, we should be skeptical when interpreting any responses about "wilderness" use and experience in studies where wilderness is not clearly defined for or by the respondents. It is usually not possible to discriminate between the valid/informed responses and invalid/uninformed responses. This could pose special problems when comparing past experience measures (or other wilderness-related variables) from different areas (some of which may have knowledgeable respondents and some of which may not).

There are also implications for management if respondents think everything, from the Bob Marshall to their local state park is Wilderness, because they may respond differently to proposed actions such as use limits or camping restrictions. For example, our study asked whether respondents support prohibiting camping in some parts of wilderness or requiring permits to enter wilderness. These questions were phrased for "federal wilderness areas in general." Some visitors (and perhaps a larger percentage of low-knowledge visitors) may oppose such actions, believing that they are not appropriate for the local state park (to which they think we are referring). They might, on the other hand, be more apt to think such actions would be appropriate if they understood the location, extent and purpose of the NWPS.

This possibility leads naturally to a discussion of the role and merits of wilderness education. Clearly, there is room for improvement in conveying why and where the NWPS exists. There is also a very intriguing relationship between wilderness knowledge and level of support for actions consistent with the Wilderness Act. We did not suspect *a priori* that knowing about wilderness would entail supporting purist wilderness management policies, but this clearly seems to be the case for SNP hikers.

Proposed Solutions for Research Efforts

At a minimum, researchers should use a filter question to assess wilderness knowledge. However, not many respondents selected our filter question, and those who did not were mostly incorrect in naming a wilderness area. Thus, we recommend using a self-assessment measure of wilderness knowledge. We have found the particular measure we used generates different distributions in different settings, and thus seems to have one of the discriminatory properties desirable of survey questions. For example, among Grand Canyon commercial boaters, 46% said they had never heard of wilderness (vs. 10% at SNP). Among private boaters in the Grand Canyon, 77% said they know a little or a lot about wilderness (vs. 38% at SNP). Furthermore, this self-assessment was well correlated with our single objective measure of knowledge, although we would welcome additional tests of its validity.

If it is crucial for the researcher to know whether respondents are truly knowledgeable, questions to test knowledge should be used as a validity check. Our measure—having respondents list wildernesses—was useful, but also problematic, primarily because many respondents listed national parks that have wilderness, and we could not tell whether they were aware of or thinking about the wilderness portions of these parks. For this reason, we suggest also asking about specific management policies in wilderness. These questions should test knowledge of wilderness principles such as the prohibition on motorized vehicles. Examples could include: Are cars allowed in wilderness areas? Are mountain bikes allowed in wilderness areas? Other questions might probe the respondents' knowledge of distinctions between land classifications, because it is clear that many SNP hikers were confused about the differences between national parks and wilderness areas.

If a manager is seeking to understand support for proposed policies, he or she should be clear about where those would be implemented. Ideally, respondents would be informed of the geographical scope of such policies before asking opinions, so that they would understand they are not being proposed (for example) for all national parks. Future research is needed to show if such education would affect opinions on wilderness management.

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Meanings and Implications of Acceptability Judgments for Wilderness Use Impacts

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Abstract—While the concept of "acceptability" is central to theLimits of Acceptable Change (LAC) framework, there is inadequate understanding of how "acceptability" is judged and how unacceptable conditions affect visitor experiences. To address this knowledge gap, visitors to nine wilderness areas were interviewed. Judgments of social and environmental conditions fell into three categories: acceptance, nonacceptance, and conditional acceptance (in which visitors were not entirely satisfied but felt that achieving a more acceptable condition might have negative consequences). Persons expressing conditional acceptance used one or more of three coping strategies: rationalization, within-setting displacement or remediative behavior. Environmental impacts were more likely to be judged unacceptable than social impacts, especially in urban-proximate settings.

Public land managers increasingly must consider the "social acceptability" of their management strategies, and of the social and biophysical conditions those strategies produce, both within and outside of wilderness areas. Wilderness planning in the USDA Forest Service typically follows a Limits of Acceptable Change (LAC) framework, whereby standards are set for wilderness conditions and use impacts based on constituents' and/or managers' judgments of what constitutes an "acceptable" level of human influence (McCool and Cole 1997; Stankey and others 1985). The LAC framework is designed for consensus-building, bringing together the various interests and constituencies who must negotiate standards for wilderness conditions based on their differing conceptions of acceptable levels and types of change. Social acceptability also is a keystone objective, along with ecological sustainability and economic feasibility, of the ecosystem management approach that now guides public land management on all federal lands in the United States. Yet there remains an inadequate understanding of what constitutes "acceptability" with regard to the practice of wilderness management in particular, and public land management in general (Brunson and others 1996; Stankey and Clark 1992).

If social acceptability of management practices and conditions is a goal of public land agencies, both in and around wilderness, it is important that we understand what is meant when a setting condition or management decision is judged "acceptable" or "unacceptable." To give a wilderness example, managers must understand whether the standards expressed by stakeholders in an LAC process are meant to be targets (what they prefer to see as the lower end of a preferred range of conditions) or thresholds (what they are willing to encounter before an experience is diminished beyond tolerable limits). If both meanings of acceptability are possible, it is valuable to know which meaning stakeholders are more likely to apply to a particular type of impact.

This paper describes research intended to help managers understand what wilderness visitors mean by judgments of acceptability, and what the consequences for visitors might be if managers are unable to achieve or maintain acceptable conditions. We analyzed qualitative data from onsite interviews of visitors to nine western U.S. wildernesses. The respondents were asked questions aimed at illuminating two research questions: (1) What is meant by statements that a social or environmental condition is "acceptable"? and (2) What are the implications of nonacceptable conditions for current and future wilderness experiences?

What Is "Acceptability?"

Public concerns about natural resource management practices and conditions have gained attention with the rise of political protests and judicial intervention in management activities. One factor in the shift to an ecosystem management approach was a need to address complex or "wicked" problems in ways that are ecologically, economically and socially appropriate (Stankey 1995). In a problem analysis addressing social issues associated with the transition to ecosystem management in the Forest Service, Stankey and Clark (1992) found that land managers did not adequately understand what constitutes "acceptability" with respect to the practice of national forest management, nor did they understand the behavioral consequences of differences in how people perceive acceptability. Brunson (1996) subsequently examined the literature of natural resource management and the social sciences and developed the following definition:

> [A]cceptability in forest management results from a judgmental process by which individuals (1) compare the perceived reality with its known alternatives; and (2) decide whether the "real" condition is superior, or sufficiently similar, to the most favorable alternative condition.

The term "social acceptability" is given to the expression of these individual judgments by identifiable and politically relevant interest groups or other segments of the public. Usually this occurs only if the evaluated condition or management action is judged inferior to an alternative condition or action that is *believed to be achievable*, so that members of the public take actions they believe can shift conditions toward a more favorable alternative. In addition to

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achievability, Brunson (1996) found that acceptability judgments often are influenced by considerations of equity, i.e., whether the imagined alternatives are sufficiently fair to others besides the evaluator.

Only if the questions about an alternative's preferability, achievability and equity are satisfactorily answered will the existing condition be judged "unacceptable." At that point, action will be taken which is likely to create or restore the favorable alternative. That action may be a personal behavior (such as choosing a more remote campsite) and/or a political one (such as seeking to influence a management plan to reduce crowding at popular camping areas). These actions fall into the general category of "coping behaviors." Conversely, people who find a condition or action acceptable are likely to remain silent about it. However, managers need to be wary of silence, because sometimes it may not signify acceptance, but instead a lack of the resources needed to express displeasure.

Petty and Cacioppo (1986) proposed a "social judgment theory" which suggested that people make acceptability judgments by identifying ranges of acceptable and unacceptable conditions that may not be contiguous; that is, there can be an intermediate range about which they are noncommittal. Williams and others (1992) used this premise to study the variability of users' judgments about the acceptability of social impacts in wilderness. Their findings support the theory with regard to wilderness users' judgments about impacts, in that numerous respondents indicated levels of impact in a mid-range that was neither acceptable nor unacceptable.

Coping With Less Than Optimal Conditions

Research on acceptability of wilderness impacts has tended to focus on identifying what those impact levels might be (Lucas 1980, Roggenbuck and others 1993) rather than how those judgements are developed. Researchers have not examined the consequences of failure to achieve LAC standards for wilderness experiences. However, there has been considerable study of the use of personal coping behaviors—the means by which individuals relieve the stress or anxiety associated with a negative impact under suboptimal conditions—in wildland recreation settings. Becker (1981) provided a definition of coping behavior that is particularly relevant to this research. He explained coping behavior as "a move away from an unacceptable situation rather than a move toward an optimal one." Based on this definition, we can expect the threshold of acceptability to occur when visitors choose displacement from a situation rather than continuing to accept it.

Hammitt and Patterson (1991) expanded on Becker's conceptualization when they observed that coping behaviors can either be behavioral or cognitive. They suggested that displacement, product shift and rationalization serve as the three types of coping mechanisms. Anderson and Brown (1984) defined displacement as a change in behavior caused by a perceived adverse condition in the recreation environment, which can occur at either a micro level (within a particular site) or macro level (between sites). Micro-level displacement can consist of a change in site within a preferred setting, or a change in timing of a visit to that setting (Anderson and Brown 1984; Shelby and others 1988). Brunson and Shelby (1993) proposed that displacement strategies are preferred when they are most likely to allow visitors to continue to enjoy the originally sought experience. Thus micro-level behavioral coping is preferred over macro-level displacement, unless the former is not possible or is judged likely to provide an unacceptable experience.

Product shift is a cognitive mechanism whereby an individual, when faced with an unanticipated negative condition, re-evaluates and mentally adjusts to the recreation experience she/he is having. In doing so, the visitor becomes satisfied in spite of the negative impact. Shelby and others (1988) concluded that product shift was the most commonly used coping strategy of boaters on Oregon's Rogue River.

Rationalization is suggested as a cognitive coping strategy by dissonance theory (Festinger 1957), which states that humans are psychologically motivated to be consistent; if activities or situations fail to achieve their objectives, they may rationalize the experience to restore cognitive consistency. Since recreation is a voluntary activity, people may be motivated to rationalize most impacts as acceptable. Hammitt and Patterson (1991) identified rationalization as the least documented coping strategy in wildland research.

Kuentzel and Heberlein (1992) suggested that there is a hierarchy of coping strategies. Their model proposed that different coping strategies parallel different levels of perceived impact: with increasing impact, a visitor will shift from a noncoping state to adopt a cognitive coping strategy, then to a within-site behavioral coping strategy before finally leaving a site altogether.

Despite the rather extensive literature on coping with wildland recreation use impacts, the LAC framework does not really account for coping strategies at all. Instead, it defines impacts as either acceptable or unacceptable. Williams and others (1992) found a middle range between those two conditions. It may be that coping is most likely to occur within that noncommittal range. Alternatively, the noncommittal range may indicate that micro-level coping strategies are no longer effective. Either way, wilderness managers clearly can benefit by knowing more about what judgments of acceptability mean; without such information, they cannot be sure of the consequences of unmet standards for wilderness visitors.

Research Methods

Given that the focus of this research was to explore the meaning of acceptability judgments for wilderness conditions, and since there was little or no prior research to guide the research, a qualitative research approach was chosen. Data for analysis consisted of wilderness visitors' own words, instead of imposed categoric or numeric responses. A "grounded theory" approach (Glaser and Strauss 1967) was used, in which inductive reasoning is employed to discover any theory that might emerge from the data, and that theory is then tested using a hypothetico-deductive approach and quantitative methods. This paper describes only the qualitative phase of the study.

Interview Sampling

Semi-structured interviews were conducted with 97 visitors to nine wildernesses or wilderness study areas in the western U.S. The wildernesses selected were administered by the Forest Service or Bureau of Land Management and represented a range of biophysical settings from the California Coast Range to the central Rocky Mountains to the Colorado Plateau. These areas were categorized in two dichotomous ways: urban-proximate versus urban-distant, and large (where multi-day trips are common) versus small. The wildernesses where sampling occurred were:

Small, urban-proximate—Lone Peak, Mount Olympus, Mount Timpanogos, Twin Peaks (all UT).

Small, urban-distant—Castle Crags (CA).

Large, urban-proximate—High Uintas (UT).

Large-urban-distant—Bridger (WY.), Grand Gulch Primitive Area (UT), Paria Canyon (UT-AZ).

A convenience sampling strategy was used. The interviewer contacted wilderness visitors at trailheads, attraction points, campsites or beside trails. In groups with adults and children, the adults were interviewed. Attempts were made to interview all parties encountered at trailheads, except those who arrived while another interview was under way. Interviews inside wildernesses were sought only if they could be done without compromising visitors' experiences. A total of 52 interviews were completed at the more remote wildernesses and 45 at urban-proximate areas. Sampling occurred on weekends or other times, such as university vacations, when use was expected to be highest and impacts (especially social impacts) were expected to be most salient to the respondents.

Data Content and Analysis

An interview protocol was developed in which several questions were asked of all respondents, but "probes" could be used when respondents' initial statements suggested the need for further exploration. General questions asked in all interviews focused on: visitors' feelings about the conditions found in the area; conditions (if any) that were found to be unacceptable; reasons for judgments that a condition was unacceptable; effects of an unacceptable condition on the present trip; and effects on future visits to the wilderness where the survey took place. The question format asked respondents to consider both social impacts (crowding, user group conflicts, depreciative behaviors) and environmental impacts (trail erosion, fire rings, evidence of horse use). Basic demographic and trip characteristic data were also collected.

Analysis of data involved procedures of open and axial coding, as described by Strauss and Corbin (1990). Open coding is the process by which interview data are fractured into discrete parts, closely examined, and compared for similarities and differences. Questions are then asked about the data, based on the investigator's own observations as well as assumptions rooted in prior research literature. Axial coding involves reassembling data in new ways based on the contexts in which the described phenomena are embedded.

Results

Wilderness users who were questioned about the acceptability of the wilderness conditions they encountered generally expressed their feelings in one of three ways: (1) nonacceptance; (2) unconditional acceptance; or (3) conditional acceptance, in which respondents said they judged impacts as acceptable, but only because they were willing to sacrifice some aspect of what they would consider an ideal experience. Responses in each category differed in how impacts were described and how those impacts affected current and future experiences in that wilderness.

When Impacts Are Unacceptable

Persons who judged an impact as unacceptable made up 13% of the total sample. Although both social and environmental impacts were judged as unacceptable, environmental impacts were more commonly viewed as unacceptable. In addition, respondents appeared to have lower thresholds for encounters with environmental impacts than for social impacts; that is, people were more likely to judge impacts such as litter, tree carving, or fire rings as unacceptable after just a few encounters, while more encounters were required for social impacts to reach unacceptable levels.

Judgments of unacceptability often were accompanied by a call for management action. For example, a backpacker in the Bridger Wilderness said about trail erosion, "If the area is going to last, then I'd say the trails need to be addressed right away." Similarly, a High Uintas visitor who considered the amount of packstock use unacceptable said, "I don't mind seeing some packers, but there should be a limit."

Impacts judged as unacceptable typically did not have lasting effects on the current experience. Most visitors said the impacts had an effect when they occurred, but they then forgot about them. A few respondents said the impacts changed the course of their trip, but they still described the overall trip positively.

Unconditional Acceptance of Impacts

Those who unconditionally accepted wilderness conditions on the trip where they were interviewed made up 17% of visitors surveyed. A slightly higher proportion of interviews with unconditional acceptors took place in urban-proximate wildernesses than urban-distant areas. Respondents in this category would sometimes acknowledge that wilderness impacts occurred, but said they had not been affected by those impacts on that visit. One man in the Bridger Wilderness said, "It's great to see a place that is like it was 30 years ago—there's no litter. You can't drink the water, but there are things you can do to get around that." At times, an unconditional acceptor would include a note of surprise about the lack of impacts they found. A visitor to the Lone Peak Wilderness, which overlooks the Salt Lake City and Provo metropolitan areas, said, "[The area] looks real good. I am surprised there's not more abuse here."

Conditional Acceptance of Impacts

Those who conditionally accepted the wilderness conditions they encountered made up 70% of visitors surveyed at both the urban-proximate and urban-distant locations. Respondents made both cognitive or behavioral adaptations to impacts in order to maintain acceptance of wilderness conditions. Three types of adaptations were identified: rationalization of the impact, remediative action taken to reverse the impact, and micro-site displacement from the impact site.

Rationalization—Rationalization was the most common adaptation used by those who conditionally accepted an observed wilderness impact (50% of all reported adaptations). The justifications most commonly given for suboptimal conditions were: consistency of impacts with expectations; "it could be worse" responses; equity concerns; and rejection of means to achieve superior conditions.

Expectation-based rationalizations were common, especially in response to social impacts. Respondents often accepted a level of impact that they characterized as less than optimal because the impact they experienced was close to, or lower than, what they had expected to experience on that visit. One person hiking in the Bridger Wilderness, who had first described the area as "crowded," then said that the impact was not unacceptable because "it's about standard, based on previous experiences. This is one of the more popular places in the [Wind River Range]. I'd say this is how it is up here." A day hiker at Lone Peak described the area as having "too many people, a lot of people," but still acceptable because, "For Saturday morning this close to Salt Lake City, what could you expect?"

When environmental impacts were rationalized, respondents sometimes suggested that conditions were acceptable because they were not as bad as they could be, given the amount of use the area receives. One person visiting the High Uintas Wilderness used this rationalization to accept suboptimal conditions he identified with domestic packstock. When asked if he considered the impact unacceptable, he replied, "No, for the amount of [horse] traffic here, the place is in real good shape."

Another common theme among those who rationalized social impacts was a concern about fair access to wilderness settings. Respondents stated or implied that since wilderness is a public resource, everyone has a right to use the area as needed. A typical comment was this one from a Lone Peak Wilderness visitor: "I would like to keep the area just for me, but it's here for people to enjoy." Packstock impacts sometimes were rationalized due to equity concerns; as a backpacker in the High Uintas Wilderness explained, "I guess I don't care for the horses that much, but they have a right to be here, too."

A closely related rationalization entailed rejecting what people imagined to be the most likely means to achieve better conditions: use restrictions. This justification was given in response to both environmental and social impacts. One frequent visitor to the High Uintas Wilderness illustrated this sentiment in his statement, "There's no other way to deal with people than to accept them. I don't agree with restricting [use in] the area."

Remediative Action—Visitors who judged suboptimal conditions as acceptable often took action to improve the negative impact(s) they experienced. All of these actions were responses to environmental conditions, usually litter. It was not clear whether the remediative act was seen as a way to feel better about the experience, or simply an obligatory response. As one backpacker in the Twin Peaks Wilderness said, "I try to stay loose about it. It's beyond my control. I pick up trash, but you can't let it ruin the experience." This method was reported by 13% of conditional acceptors, often in conjunction with other coping mechanisms. For example, the person quoted above continued by expressing concern about management action to control impacts, stating, "Limits around here are unnecessary right now."

Micro-Level Displacement—Displacement away from negative impacts was reported by 36% of those in the "conditional acceptor" group. Primarily in response to social impacts, people described choosing different routes or campsites, traveling farther than they had planned or stopping sooner. For example, a group of hikers having lunch in the Lone Peak Wilderness—an area they had described as "crowded"—said, "It hasn't affected us too much. We'd be over there having lunch [instead of here] though," pointing to an area occupied by a number of people.

Effects on Future Visits

Displacement, both micro- and macro-level, was frequently mentioned by visitors when asked how impacts they encountered might affect future visits to the wilderness where they were interviewed. Some felt that future visits might be affected but weren't sure, or they said that the effect would depend on the circumstances of subsequent visits.

A large majority of visitors who judged an impact unacceptable said it would affect their decisions about future trips—that they would look for areas with lighter impacts or would not come back at the same time of year. One person said he would never use the same trailhead again. Among those who expressed conditional acceptance, displacement was mentioned less frequently as an effect on future visits to urban-proximate areas than on visits to more remote wildernesses. When urban-proximate visitors predicted they would change future plans, they usually explained that they would choose another day of the week to visit. At more remote areas, visitors mentioned both temporal and spatial adjustments. One person in the Bridger Wilderness stated, "I'll look for an area with less traffic, especially less horse traffic." Another Bridger visitors would "come at a different time, later in the year, to see fewer people."

Several persons reported that they had already taken precautionary measures to avoid anticipated social impacts. For example, a Twin Peaks visitor reported that she "got going early so as to not see too many people." A couple who said they visit the Twin Peaks Wilderness twice a week noted, "On Sunday we go elsewhere because the numbers are unacceptable to us then." A High Uintas visitor said he specifically chose not to go into a popular region of the wilderness to "avoid the crowds." Experienced visitors who had chosen not to displace themselves often offered reasons of place attachment. For example, a Lone Peak hiker said, "There's only one Pfefferhorn. We have to come back once a year to climb it."

Discussion and Implications

As suggested by the results of this study, visitors' judgments about the acceptability of wilderness impacts include consideration of the contexts of the impacts experienced, the types and levels of impact experienced, and the strategies possible to avoid experiencing unacceptable impacts (table 1). These findings are consistent with Brunson's (1996) suggestion that acceptability judgments are made only after comparison with known alternative conditions. Judgments often were made in light of prior expectations about the conditions to be encountered. This is consistent with many prior studies of social impacts in wildland settings; indeed, comparison of actual and expected conditions forms the basis for judgments about recreation carrying capacity (Shelby and Heberlein 1986). As Brunson (1996) previously observed in a study of acceptability of timber harvest methods, judgments in this study were made in light of equity considerations and the desirability of probable means to achieve alternative conditions. Contrary to Brunson's predictions, judgments of unacceptability were rarely accompanied by a call for *political* action; instead, respondents who found impacts unacceptable often called for *management* action to restore acceptable conditions.

We asked about both social and environmental impacts, and found that our respondents were more likely to judge the latter as unacceptable. Standards for environmental impacts also tended to be more stringent, in terms of the frequency of encountering suboptimal impacts. This finding is consistent with work by Roggenbuck and others (1993), who found that site impacts were more influential than social encounters in defining wilderness experience quality.

Perhaps our most striking finding was the high percentage of "conditionally acceptable" judgments. These judgments fall into the mid-range between acceptability and unacceptability, as predicted by Petty and Cacioppo (1986) and supported by Williams and others (1992). However, they do not represent a noncommittal response so much as an adjustment made to restore conditions to an acceptable status. In other words, wilderness visitors in this study relied heavily on coping strategies in order to maintain a high-quality wilderness experience in spite of suboptimal conditions. This discrepancy may have been influenced by the methodology, as our qualitative approach encouraged respondents to explain what they meant by a response that was neither unconditionally acceptable nor unacceptable.

The use of coping strategies is well-documented in the recreation literature (Anderson and Brown 1984; Brunson and Shelby 1993; Hammitt and Patterson 1991; Shelby and others 1988). As predicted by Hammitt and Patterson (1991), both cognitive and behavioral strategies were employed; both temporal and spatial displacement were reported; and spatial displacement took place at both micro- and macro-levels. However, our results differed from those predicted by Hammitt and Patterson (1991) in two respects. First, we found little evidence of product shift by our interviewees. This may reflect a tendency for our respondents to be frequent wilderness visitors, especially to the urban-proximate areas near Salt Lake City. Second, we identified a behavioral coping strategy, remediative behavior (such as picking up litter left by others), that has rarely been mentioned in prior discussions of coping.

Hammitt and Patterson (1991) suggested that rationalization is the least documented of the coping strategies used in wildlands. Our study provides such documentation; indeed, rationalization was the most common strategy we observed for coping with suboptimal conditions. Rationalization typically entailed placing suboptimal impacts into a larger context, such as a recognition that impacts could easily be greater or that reducing impacts could only be accomplished through undesirable or inequitable restrictions on use.

Nonoptimal conditions typically were said to affect future visits more than current ones. Even the unacceptable impacts were generally reported to have only a temporary effect on the quality of the wilderness experience. As predicted by Brunson and Shelby (1993), people who expected to be displaced in future trips were more likely to look for new ways to enjoy the same setting, rather than opting for macro-level displacement. This was especially true for visitors to urban-proximate areas, who may find it difficult to substitute other sites that are as convenient to visit in a short time frame.

The wildernesses chosen for this study differed in terms of their size, distance from urban areas, geographic location in the West, and administering agency (BLM or Forest Service). Of these variables, only urban-proximity was found to have an association with acceptability judgments. Visitors to urban-proximate wildernesses were more likely to say they would continue to visit the area despite suboptimal conditions, and they also were slightly more likely to express unconditional acceptance of conditions they encountered.

Implications for Planning and Management

Wilderness planning and management strategies need to account for the deeper meanings of "acceptability" to wilderness visitors. The frequent use of coping strategies may lead

Table 1—Summary of three types of acceptability judgments.

	Unconditionally acceptable	Conditionally acceptable	Unacceptable
General response	It's OK	It's OK if ...	It's not OK
Means of coping	N/A	Rationalization Remediative action Displacement	Displacement
Effect on current visit	None	Usually minimal	Usually minimal
Effect on future visits	None	Usually none	Displacement

to a false impression that wilderness conditions are not suboptimal—especially since, as Brunson (1996) has noted, acceptability is a condition more easily observed when it no longer exists. One might argue that diligent monitoring of LAC standards can detect problems before conditions become unacceptable. However, that argument assumes that standards truly represent limits of change beyond which conditions should not be allowed to degrade.

Our findings may indicate that this is not always the case. The willingness to rationalize suboptimal impacts may indicate that visitors perceive relatively stringent standards—especially for social impacts—as "yellow lights" that indicate a need for caution rather than "red lights" that indicate where change must stop. Alternatively, since acceptability judgments often are expressed in terms of the unfairness or undesirability of restrictions on wilderness recreation, participants in an LAC process may set looser standards than they should in order to avoid the need for such restrictions. Managers should be sure to ask questions that explore these nuances during negotiations to set LAC standards.

Decisions on how to allocate resources during LAC monitoring should be made in light of knowledge about how visitors cope with suboptimal impacts. In the absence of such information, managers may waste time and money attempting to maintain standards for impacts with which visitors can easily cope. Such standards may describe a condition that is ideal or desirable, but not necessary to visitors' experiences. On the other hand, the condition might be necessary to some, but other visitors can adapt to violated standards on their own without management intervention. In this case, managers may find themselves creating an even less acceptable impact by taking a restrictive management action to restore conditions to within acceptable limits.

However, managers also must consider whether visitor preferences are the most important factor in setting LAC standards or in choosing strategies that can restore conditions to acceptable levels. Ecological expertise may be needed to judge the sustainability of conditions that visitors find acceptable—for example, when visitor use reaches levels that can reduce wildlife survival or reproductive success. The relative weight given to ecological or social criteria for wilderness management should depend on the rarity of the recreation experience provided versus the rarity of the ecological condition that might be protected. Furthermore, the fact that visitors are able to cope with suboptimal conditions serves to reinforce Shindler's (1992), warning against a "law of diminishing standards" for wilderness.

Finally, we found that visitors to urban-proximate areas judged impacts differently than did visitors to more remote areas, and those impacts also were likely to have different effects on future wilderness visits. Since the Wilderness Act makes no distinction between urban-proximate and urban-distant areas in terms of overall preservation goals or allowable management actions, it is important for managers throughout the wilderness system to engage in an ongoing dialogue about how the needs and preferences of urban-proximate wilderness visitors can be accommodated within the spirit of the Act.

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Developing Social Standards for Wilderness Encounters in Mount Rainier National Park: Manager-Defined Versus Visitor-Defined Standards

Kristopher J. Lah

Abstract—This research compared the differences found between manager-defined and visitor-defined social standards for wilderness encounters in Mount Rainier National Park. Social standards in recreation areas of public land are defined by what is acceptable to the public, in addition to the area's management. Social standards for the encounter indicator in Mount Rainier's General Management Plan are based on current use at the Park and research performed in other wilderness areas. It was hypothesized that these standards are not representative of user's level of acceptability. This hypothesis was supported through analysis of responses given by visitors on a short survey, who indicated acceptable encounter levels below the manager-defined standards.

Wilderness, as defined by the Wilderness Act of 1964, is to offer the public "outstanding opportunities for solitude or a primitive or unconfined type of recreation" (P.L. 88-577). The Wilderness Act requires managers to preserve the ecological components and opportunities for solitude. One social dimension of wilderness is the level of human use that an area can accommodate before the wilderness experience is diminished. This level of use is referred to as an area's visitor carrying capacity (Hendee and others 1990).

The National Parks and Recreation Act of 1978 required each Park's General Management Plan (GMP) to include "identification of and implementation commitments for visitor carrying capacities for all areas of the unit" (P.L. 95-625). Effectiveness of the visitor carrying capacity concept depends on how well the social components of an area are understood. The new planning method, the Visitor Experience and Resource Protection (VERP) framework, defines social carrying capacity as "the type and level of visitor use that can be accommodated while sustaining the desired resource and social conditions that complement the purpose of the park units and their management objectives" (National Park Service 1993). Since carrying capacity decisions are value-laden, public involvement is critical in the VERP planning process. Public opinion helps define important values in a park, allowing managers to ascertain acceptable and unacceptable visitor conditions, and determine appropriate management actions and limitations (National Park Service 1997).

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Background

VERP and Social Carrying Capacity

VERP is a planning method which has evolved from two other frameworks that place management focus on conditions rather than numbers: The Limits of Acceptable Change (LAC), used by the Forest Service in wilderness planning and Visitor Impact Management (VIM), developed by the National Parks and Conservation Association. LAC is a planning process in which the amount of change to be allowed is definitively expressed by quantitative standards, the management actions needed to prevent further change are ascertained, and methods for monitoring and evaluating management strategies are instituted (Stankey and others 1985). VIM involves a description of the association between two specific situations, the impacts associated with these situations and an assessment that evaluates the acceptability of various impacts (Graefe and others 1990).

VERP's nine-step procedure (table 1) is very similar to that of LAC. However, VERP is not limited to wilderness and backcountry planning, which has usually been the case of LAC. In addition, the first seven steps in the VERP framework fulfill the requirements in a general park plan. However, some older GMP's may require an independent Visitor Use Management Plan if they have not previously addressed

Table 1—Nine elements of VERP.

Element 1	Assemble an interdisciplinary project team
Element 2	Develop a public Iinvolvement strategy
Element 3	Develop statements of park purpose, significance, and primary interpretive themes; identify planning mandates and constraints
Element 4	Analyze park resources and the existing visitor use
Element 5	Describe a potential range of visitor experiences and resource conditions (potential management zones)
Element 6	Allocate the potential zones to specific locations within the park (prescriptive management zoning)
Element 7	Select indicators and specify standards for each zone; Develop a monitoring plan
Element 8	Monitor resource and social indicators
Element 9	Take management action

National Park Service 1997.

the issue of carrying capacity. This is significant in the Mount Rainier project because the GMP is being written in conjunction with VERP.

While the last two steps of VERP are not essential to the GMP revision process, they play an integral role in park management. These steps are under annual evaluation and are a prescription for monitoring the conditions of the area. Step seven of the VERP framework is to select quality indicators and specify associated standards for each zone. Understanding the characteristics of quality indicators and standards and the role they play is imperative in comprehending the purpose of this research.

Social Indicators and Standards

Indicators are specific, measurable impact variables that reflect the overall conditions of a park. Social indicators measure visitor impacts on other park visitors experiences (National Park Service 1997). Often, the number of indicators selected in a plan is limited, so selection of indicators is critical. Merigliano (1990) offers useful criteria for selecting the best indicators.

While Watson and others (1990) have developed a list of indicators often used in the U.S. Forest Service, it is unknown if they are appropriate for developing monitoring programs in wilderness areas of the National Park Service because they have not been tested. It has been suggested that deciding what impacts matter most can be identified in several ways. While consulting the literature and using managerial judgment are effective methods, public input should also be included in developing indicators (Merigliano 1990; National Park Service 1997; Whittaker 1992). Because social indicators are value laden, all parties that might be affected by impacts should have the opportunity to play a part in their development.

A concern that was recognized in the first public meetings held for Mount Rainier's GMP was that wilderness solitude is diminishing. As Twight and his colleagues (1981) have suggested solitude is a function of intimacy, where intimacy is defined as the opportunity to be "alone with others" in a close shared experience. A variable that has been recognized as a good indicator of solitude is the number of visual encounters with other groups (Merigliano 1990; Potter and Manning 1984; Roggenbuck and others 1993).

Social standards in recreation management refer to levels of impact that are defined as acceptable to visitors, and they can be established for impact variables or indicators (Whittaker and Shelby 1992). An important component of wilderness planning approaches, we have learned, is assigning standards based on input from the public. Public involvement in the VERP planning process is important because value-weighted decisions have to be made (National Park Service 1997). Standards enable managers to be proactive rather than reactive in preserving quality recreation experiences into the future. Standards may start out as value judgments, but if their design is based on scientific research, they become defensible. A good standard should be quantifiable, time-bounded, attainable and output-oriented (Whittaker and Shelby 1992). To ensure that standards can be measured and maintained, a good standard must be a numerical value. Indicators often start out as purely qualitative, but become measurable when a quantitative standard is assigned to it. The time-bounded characteristic is a counterpart to the quantifiable characteristic. With a time frame, the standard becomes more precise. A standard that is too difficult to accomplish, however, may be undesirable and frustrating. Standards should be attainable. An output-oriented standard focuses on the desired condition to be met rather than the way the standard is met. It focuses on the acceptable impact level, not on the tools used to keep impacts from exceeding standards.

Planning at Mount Rainier National Park

This research was conducted in the designated wilderness of Mount Rainier National Park. Visitation to the Park has drastically increased over the past few decades. In 1974, the annual number of visitors to the Park was 1.5 million; by 1994, it had exceeded 2.3 million (Mount Rainier National Park 1996). Wilderness use increased 69% between 1989 and 1994, with the strong majority of use being from day hikers (Mount Rainier National Park 1996). As early as 1973, Park management recognized the negative effects of increased use in the backcountry and implemented a Backcountry Use and Operations Plan. The 1973 plan outlined methods for managing the increased use which included establishing limits on party size in the backcountry (National Park Service 1989-92). The 1989-92 Wilderness Management Plan for the Park lists the history of attempts to handle the changes in use between 1974 and 1992.

In 1994, planners at the Denver Service Center and managers at Mount Rainier National Park began revising their GMP. They utilized the VERP framework to revise the Park's GMP and the Wilderness Management Plan (Samora personal communication).

Park planners first met in October 1994 and formulated the Park's statement of purpose and significance. This statement guides the VERP planning process. Fourteen of the Park's social, biological, cultural and historical attributes were recognized as significant. These significant resources helped to determine the purpose of Mount Rainier as a national park. The purpose of the wilderness portion of the Park was to "maintain wilderness values and provide for wilderness experiences" (Mount Rainier National Park 1995). Two unique values of wilderness are that they are untrammeled natural areas and provide an opportunity for solitude (PL 88 577). Maintaining these values are therefore recognized as an obligation of the National Park Service.

The public joined the planning process in November 1994, when public meetings were held in several towns in Washington State. Six issues were presented at each public meeting for the public's consideration and input. One issue, "wilderness resources and use", is particularly relevant to this research (Mount Rainier National Park 1995).

Planners used information collected at the public meetings to develop a range of three summer management alternatives: (1) Improve access to many parts of the park; (2) provide additional opportunities for recreation; (3) increase opportunities for solitude. Management zones were described to represent combinations of these alternatives. Each management zone has standards for the amount of use allowed. Alternative management approaches designed to

increase visitor access would be employed in management zones that allow a higher number of users.

A newsletter sent to the public in March of 1997 explained the objectives and details of each alternative. The public was asked to comment on all three alternatives and select one. The planners then compiled the responses and selected a preferred alternative. With the selection of a preferred alternative, the planners were able to move through another step in the planning process by mapping out the desired future condition. The Park then began the process of writing an Environmental Impact Statement for the selected alternative.

Management Zones and Corresponding Standards

Encounters have been used as an indicator in many recent planning studies when solitude was an issue (Hall and Shelby 1996; Lewis and others 1996; Patterson and Hammitt 1990). The indicators that have been developed by the planning team to monitor solitude in the wilderness areas of Mount Rainier are encounters per day and encounters per hour (based on an eight-hour day). Encounters are defined as "the number of people outside an individual's group that are met during periods of peak use (peak hours of peak days of peak months)" (Mount Rainier National Park 1997). The level at which encounters become unacceptable is determined by assigning an appropriate standard to it.

The National Park Service during Mount Rainier's VERP planing process developed wilderness standards for the indicators "encounters per hour "and" encounters per day. The plan divided the Park into six different management zones, which would allow different levels of encounters. Standards for encounters are part of each zone's definition. Therefore, there should be differences in what users in each zone think is acceptable. Table 2 displays the standards for encounters per hour and encounters per day that have been assigned to each zone.

The Park developed standards for encounters per day in two ways. The standards for the Pristine and Primitive zones were produced by a review of a study conducted in the Eagle Cap Wilderness (Hall and Shelby 1994). Standards in the remaining zones (Semi-primitive, Moderate Use Climbing, Transition and High Use Climbing) for "encounters per hour" and "encounters per day" are based on management's knowledge of the current use levels from trail counters and Park records (Samora personal communication). While the planning team allocated six wilderness zones, research was only conducted in the Semi-primitive, Moderate Use Climbing, Transition and High Use Climbing zones because of concerns of displacement of visitors in these zones and financial limitations.

While the indicators (encounters per day and encounters per hour) are based on knowledge gained from public meetings, development of the standards lack public input. As discussed above, public involvement is important, especially when decisions on subjective topics like solitude and visitor carrying capacity are being made. Because the public was not involved in the development of these standards, it is not known if they represent levels that are acceptable to visitors of Mount Rainier. In fact, concerns are raised when one reads the most recently written planning document's information on encounters and the Park's current standards. For example, the Park's 1989-92 Wilderness Management Plan list of the "most heavily used trails during 1992" indicates that the encounter levels for these trails ranged from 21 to 49 (National Park Service 1989-92). The standards for the Semi-primitive, Moderate Use Climbing, Transition and High Use Climbing Zones (60 and 100) are well above even the most heavily used trails in 1992. If the Park standards of 60 and 100 are based on current use, is this recognizable increase acceptable to visitors? Is this increased level a level that visitors would like to have maintained?

Research Question and Hypotheses

Recognizing the methodological shortcomings in the way the Park standards were developed, the following question was proposed to guide this study: Do wilderness users at Mount Rainier National Park share the same levels of acceptability for encounters per hour and encounters per day as suggested by the social standards developed by planners for four different management zones (Semi-primitive, High Use Climbing, Transition and Moderate Use Climbing)? This research question lead to the following hypotheses:

Hypothesis 1: Wilderness users at Mount Rainier National Park will express different preferred and acceptable levels for encounters per hour and encounters per day than the current social standards developed by the planning team for four different management zones of the Park.

Hypothesis 1a: Wilderness users at Mount Rainier National Park will express a significantly different (p-value less than or equal to 0.05) acceptable level for encounters per day than the current Park standards developed by the planning team.

Hypothesis 1b: The majority of wilderness users at Mount Rainier National Park will express different preferred levels for encounters per hour than suggested by the social standards developed by planners for four different management zones of the Park.

Table 2—Summer Wilderness Zones. Encounters per hour and encounters per day.

Indicator	Pristine	Primitive	Semi-primitive	Moderate Use Climbing	Transition	High Use Climbing
Encounters per hour	0	<3	<7.5	<7.5	<12.5	<12.5
Encounters per day	0	<25	<60	<60	<100	<100

Standards apply to "peak hours" of "peak days" of "peak months." One day = eight hours.

Hypothesis 1c: The majority of wilderness users at Mount Rainier National Park will express responses for highest number of encounters per hour that are not equivalent to the current Park standards developed by the planning team for four different management zones of the Park.

Both preferred and acceptable levels for encounters were intentionally expressed in the hypothesis and studied. Standards are often based on what is acceptable; however, the word acceptable conveys a degree of tolerance. While acceptable means that a condition is tolerable, prefer means "desirable" (Random House 1988). Therefore, if the individual visitor's experience at the Park is of interest to park personnel, then maybe we should also research what individuals prefer.

The significance of management zones in providing opportunities for solitude is also important in the success of the plan. However, due to the problems in developing the standards, it is unknown if visitors to these zones have different levels of acceptability for encounters. In light of the lack of scientific evidence to suggest that there should be a difference in standards for encounters among the zones, hypothesis 2 was also proposed.

Hypothesis 2: Analysis of reported levels of acceptable number of encounters per day from the four management zones will result in no significant difference among the zones.

Hypothesis 2a: Analysis of reported levels of acceptable number of encounters per day from the four management zones will result in no significant difference (p-value < 0.008) among the zones.

Methods

Study Area

To test the hypotheses, data were collected with a self-administered survey. Two locations were selected to administer the survey in each of the four zones studied, for a total of eight survey sites. Survey sites were selected with assistance from Park managers Barbara Samora (natural resource manager) and Steve Winslow (head climbing ranger).

Survey sites in the Semi-primitive, Moderate Use Climbing and Transition zones were based on the same criteria. These zones are located in more than one area of the Park and they share the same standards for encounters. Therefore, there should be agreement among visitors within each zone, irrespective of the zone's location. To test whether agreement is confounded by location, sites with the same zone definition were selected in different sections of the Park. In addition, the survey sites within these zones were consistently positioned one half mile into each zone.

Survey site locations for the High Use Climbing zone were selected based on a different criterion than the other zones. Unlike the other zones that are each located in at least two areas of the Park, this zone is located in a single extensive snowfield. The expansiveness of the High Use Climbing zone allows the visitor to use the entire snowfield rather than a single route or trail, as is the case with the other zones. However, the user's ability to use the whole snowfield made it difficult to select survey sites within it. Therefore, survey sites had to be located at places in the zone that are known to attract visitors (rest areas, water sources, scenic vistas, etc.). In cooperation with head climbing ranger Steve Winslow, locations that attract visitors were identified.

Sampling

Standards for encounters are based on periods of "peak use (peak hours, of peak days, of peak months)" (Mount Rainier National Park 1996). Therefore, the field research was conducted during times that have been recognized as peak use. First, an eight-week period during July and August of 1997 was selected and broken down into two-week blocks. Because visitation to the Park during weekdays is much lower than on "peak days" of the week (Vande Kamp and others 1996a), Friday, Saturday and Sunday were selected primarily as field days. Finally, in addition to having peak days of the week, some of these zones also had peak hours during those days. Hours were selected as either morning, 8:00 to 12:00, or afternoon, 12:00 to 4:00. This method in scheduling was found to agree with the standards that the survey is designed to test and develop because they are defined by these peak periods (Mount Rainier National Park 1997).

To avoid response contamination visitors were approached and asked to complete a survey no more than every 10 minutes over the four-hour survey period. With four field days spent at each survey site, the total possible number of respondents for each survey site could have been a maximum of 96 respondents over the field season. This method therefore, defines the sample frame for this study as visitors to the wilderness areas of Mount Rainier National Park between July 7 to August 31 on selected days during selected periods of the day.

When visitors were approached, they were greeted and read a verbal consent script. The script asked visitors for their voluntary participation in completing a survey. The visitors were then told why the survey was being conducted and approximately how long it would take to fill out. This script served as an effective method to confront visitors and introduce the survey.

Survey

The hypotheses for this study pertain to the standards developed by the planning team for encounters per hour and encounters per day. The hypotheses and standards were tested by means of a short self-administered survey for four management zones (Semi-primitive, Moderate Use Climbing, Transition and High Use Climbing). As noted above, the Semi-primitive and Moderate Use Climbing zones share the same standards, as do the Transition and High Use Climbing zones. Therefore, only two survey instruments (one for each set of standards) were required. The two instruments only differed in questions that specifically related to the standard levels.

Results

Encounters Per Day

Hypothesis 1a—Wilderness users at Mount Rainier National Park will express a significantly different (p-value less than or equal to 0.05) acceptable level for encounters per day than the current Park standards developed by the planning team.

To test hypothesis 1a, one sample t-tests were conducted on reported levels of acceptable number of encounters per day against their corresponding Park standard. Because one sample t-tests assume a normal distribution, each of these samples was further evaluated by applying the Kolmogorov-Smirnov test of normality. The Kolmogorov-Smirnov determines whether the sample can reasonably be thought to have come from a population with the theoretical distribution, in this case a normal distribution. To further test these samples against their corresponding standard, the Wilcoxon signed ranks test was conducted on each sample. The Wilcoxon signed rank test ranks the difference between matched pairs, giving more weight to a pair that shows a large difference.

Results of the one sample t-tests for individual zones indicate a significant difference (p-value <0.05) between the mean of all of the samples and their corresponding Park standard, as displayed in table 3. Results of the Kolmogorov-Smirnov test suggest that the samples for the Semi-primitive and Moderate Use Climbing zones are normally distributed while the samples for the Transition (0.05) and High Use Climbing (0.012) zones are questionable to skewed. However, the Transition zone's sample size is considered large enough (n >30), under the Central Limit Theorem, to allow use of the t-test. Results of the Wilcoxon signed ranks test show a significant difference between the responses for acceptable level of encounters per day and the standards for all of the zones. These tests therefore support hypothesis 1a; responses for acceptable level of encounters per day were found to be significantly lower than the current Park standards for all of the zones.

Encounters Per Hour

Hypothesis 1b (Preferred Levels)—The majority of wilderness users at Mount Rainier National Park will express different preferred levels for encounters per hour than suggested by the social standards developed by planners for four different management zones of the Park.

Standards for encounters per hour (Hypothesis1b) were tested by data collected for preferred levels that respondents selected from a five-point scale. The five-point scale tested the corresponding standard by making it the third or middle level. The levels before the standard were incrementally lower than the standard, where as those above the standard were incrementally higher. For example, preferred levels for the Semi-primitive and Moderate Use Climbing zones were 3 or less, 5, 7 (standard), 9, over 9 and preferred levels for the Transition and High Use Climbing zones translate to 4 or less, 8, 12 (standard), 16, over 16. Percentages and medians of the five-point scale responses were analyzed for the samples collected in each zone.

Results of descriptive analysis of responses for preferred levels of encounters per hour reveal that the majority of users in the Semi-primitive, Moderate Use Climbing and Transition zones prefer levels for encounters per hour below the corresponding Park standard. As reported in table 4, at least 50 percent (median) responded at the second value or below the Park standard, for all of the zones except the High Use Climbing zone. Therefore, the null hypothesis is rejected for all of the zones except for the High Use Climbing zone. In fact, the median is reached at the third value for the High Use Climbing zone, which would suggest that respondents from this sample might prefer per hour encounter levels similar to the Park standard.

Hypothesis 1c (Highest Levels)—The majority of wilderness users at Mount Rainier National Park will express responses for highest number of encounters per hour that are not equivalent to the current Park standards developed by the planning team for four different management zones of the Park.

Asking respondents the highest levels of encounters per hour (Hypothesis1c) they would be willing to see also tested the standards. Responses were selected from the same five-point scale used for the preferred levels. Percentages and medians were calculated to analyze the data collected from the five-point scale responses.

Results of this analysis reveal that the Semi-primitive and High Use Climbing zones had a majority of users that responded above their corresponding standard. While the majority of respondents in the Moderate Use Climbing and Transition zones answered at the third level, their corresponding standard for encounters per hour (table 5), none of the zones had a majority that expressed the highest number of people below the park standard. The null hypothesis is therefore supported in the Moderate Use Climbing and Transition zones, but not the Semi-primitive and High Use Climbing zones.

Table 3—Results of one sample t-test and tests of normality for each zone.

Zones	Sample size	Mean	Park standard	One sample t-test	Wilcoxon signed rank	Distribution of sample
Semi-primitive	23	13.7	60	0.00	0.000	0.107
Moderate Use Climbing	13	28.9	60	0.006	0.022	0.113
Transition	38	22.0	100	0.00	0.003	0.05
High Use Climbing	20	49.9	100	0.00	0.000	0.012

Significance differences for one sample t-tests and Wilcoxon signed ranks test set at p-value -0.05. Normal distribution of samples determined by values greater than 0.05.

Table 4—Percentages for each preferred encounter level per hour and the median response for each zone.

Zone	First level	Second level	Third-level standard	Fourth level	Fifth level	Median reached at	Cumulative at second level
Semi-primitive	34.8%	42.4%	15.2%	3.0%	4.5%	2nd level	77.3%
Moderate Use Climbing	46.2%	12.8%	12.8%	20.5%	7.7%	2nd level	59.0%
Transition	40.7%	30.2%	12.8%	8.1%	8.1%	2nd level	70.9%
High Use Climbing	16.0%	28.4%	22.2%	12.3%	21.0%	3rd level	44.4%

Median—level at which majority was reached. Cumulative—percentage of respondents who responded at second level or below. Values for the Semi-primitive and Moderate Use Climbing Zones translate to 3 or less, 5, 7, 9, over 9. Levels for the Transition and High Use Climbing Zones translate to 4 or less, 8, 12, 16, over 16.

Comparison of Zones

Hypothesis 2a—Analysis of reported levels of acceptable number of encounters per day from the four management zones will result in no significant difference (p-value < 0.008) among the zones.

Conducting two independent-sample t-tests and the non-parametric Mann-Whitney test compared responses given for acceptable number of encounters per day for each zone. These two methods test the differences between two samples on one variable and are therefore appropriate for testing hypothesis 2a. While the other tests in this study are considered significant if the p-value is less than 0.05, the significance levels for these tests are adjusted for multiple tests. The Dunn's multiple comparison test also known as the Bonferroni procedure was used to avoid a type one error. Application of this procedure translated into dividing the p-value (0.05) by the number of tests (0.05/6) for an adjusted significance level of 0.008 (Kirk 1995).

Results from these tests indicate that there are only significant differences between two sets of zones: the Semi-primitive/High Use Climbing zones and the Transition/High Use Climbing zones. Table 5 shows that the tests fail to reject the null hypothesis in four of the six comparisons. These results are logical when viewing the means column in table 6; Semi-primitive = 13.65; Moderate Use Climbing = 28.85; Transition = 22.00; High Use Climbing = 49.85. Hypothesis 2a is therefore supported in four of the six zone comparisons.

Discussion and Recommendations

The results of the survey described in this paper were useful in developing an understanding of visitor attitudes about encounters with other visitors. Users' perceptions were quantified successfully to make informed and defensible decisions on the adequacy of the Park's standards. Because the standards are assigned to specific areas of the Park it was important to conduct the survey in the field. This method allowed respondents to react to the environmental and social conditions of the zone in which the standards will be employed.

Applying three statistical methods, which served to substantiate results from small samples (n < 30), tested the results for acceptable encounters per day. The data collected on this variable suggest that there are significant differences between the Park standards and acceptable levels reported in all four of the zones. Therefore, hypothesis 1 is supported in regard to encounters per day. Wilderness users at Mount Rainier National Park did express acceptable levels for encounters per day different from the park standards developed by the planning team for four different

Table 5—Percentages for each highest encounter level and the median response for each zone.

Zone	First level	Second level	Third level	Fourth level	Fifth level	Median	Cumulative
Semi-primitive	6.1%	10.6%	19.7%	42.4%	21.2%	4th level	36.4%
Moderate Use Climbing	17.9%	17.9%	20.5%	23.1%	20.5%	3rd level	56.4%
Transition	10.5%	15.1%	25.6%	20.9%	27.9%	3rd level	51.2%
High Use Climbing	6.2%	13.6%	19.8%	24.7%	35.8%	4th level	39.5%

Median—level at which majority was reached. Cumulative—percentage of respondents who responded at or below the third level. Levels for the Semi-primitive and Moderate Use Climbing Zones translate to 3 or less, 5, 7, 9, over 9. Levels for the Transition and High Use Climbing Zones translate to 4 or less, 8, 12, 16, and over 16 among the zones.

Table 6—Results of comparison of zones for acceptable number of encounters per day.

Tests	SP/MUC	SP/Tran	SP/HUC	MUC/Tran	MUC/HUC	Tran/HUC
Significance in difference	0.139	0.073	0.000	0.427	0.116	0.006
Mann Whitney significance	0.336	0.393	0.000	0.931	0.048	0.001

Significant differences values less than 0.008. SP = Semi-primitive; MUC = Moderate Use Climbing; Tran = Transition; HUC = High Use Climbing.

management zones of the Park. These findings are further supported by the results to a question about whether visitors' enjoyment would be enhanced by seeing fewer visitors then the park's standard would allow.

The majority of wilderness users either strongly agreed or agreed with the statement that: "Seeing fewer than 60 or 100 (each zones corresponding standard) people per day…would make their visit to Mount Rainier more enjoyable," (table 7). This suggests that respondents may prefer encounters below the park standards, which coincides with the mean level calculated from numeric responses for acceptable encounters per hour. Not only were acceptable encounter levels significantly different, they were also significantly lower than the Park standards.

Hypothesis 1 was also supported in reference to preferred encounters per hour for the samples collected in all the zones, except for the High Use Climbing zone. In fact, the majority of respondents in the Semi-primitive, Moderate Use Climbing and Transition zones revealed that they would prefer levels below the Park standard. The majority of users in the High Use Climbing zone selected responses for preferred encounters per hour at or below the Park standard that was being tested. However, recent adjustments to the Park standards actually raised the standard rather than lowered it. These adjustments made in the spring of 1998 (Samora personal communication) as shown in table 8, raised the encounter levels per day and per hour in the Moderate Use Climbing and High Use Climbing zones. The Moderate Use Climbing zone's standards were raised from 60 encounters per day to 75 (7.5 encounters per hour to 9). The High Use Climbing zone's standards were raised from 100 encounters per hour to 150 (12.5 encounters per hour to 19) (Samora personal communication). These adjustments are contrary to the results found through scientific inquiry and have not been explained to the public. The results in this study suggest that any adjustments to the standards should be to lower the levels. Table 8 also displays the suggested adjustment to the standards for all of the zones based on the research done in this study.

The equation that was formulated to make these suggested adjustments for each zone is: the (mean of acceptable encounters per day) + (preferred encounters per hour * 8) + (highest encounters per hour willing * 8)/3. This formula takes into account the calculated mean for acceptable encounters per day and preferred and highest encounters per hour selected by the respondents in each of the zones and develops an average from them. The preferred and highest levels were multiplied by eight because the standards for encounters per hour are based on an eight-hour day.

In addition, responses for acceptable encounters per day were found to be significantly different ($p < 0.05$) in only two of the six zone comparisons. Not only do these results support hypothesis 2, they also suggest that there should not be drastic differences in the standards. Therefore, it was logical to attempt to make the standards, suggested in table 9, closer in the zones that were not found to be significantly different. In light of the statistical analysis conducted for this research, visitors in the High Use Climbing zone are the most tolerant of encounters. So the suggested standards for the High Use Climbing zone are the highest of all the zones researched.

Conclusions

The main purpose of this study was to determine if visitor-defined standards are different then manager-defined standards for wilderness encounters. While planning teams may often find that it is difficult to function on limited budgets, the VERP process outlines the need for standards based on visitor's level of acceptability. As noted earlier, the park experienced a large increase in visitation since the 1989-92 Wilderness Management Plan was completed, however the manager-defined standards were based on this increase or

Table 7—Percentages for levels of agreement with seeing fewer than the Park standard would make visit more enjoyable.

Zone	Strongly agree	Agree	Unsure	Disagree	Strongly agree
Semi-primitive	34.8	47.0	7.6	7.6	3.0
Moderate Use climbing	35.9	35.9	5.1	15.4	7.7
Transition	37.2	34.9	10.5	11.6	5.8
High Use Climbing	22.2	39.5	9.9	17.3	11.1

Table 8—Author's suggested standards based on acceptable, preferred and highest encounter levels indicated by respondents.

	Encounters per day		Encounters per hour	
Zone	Original/adjusted standard	Author's suggested standard	Original/adjusted standard	Author's suggested standard
Semi-primitive	60/60	42	7.5/7.5	5.25
Moderate Use Climbing	60/75	42	7.5/9.0	5.25
Transition	100/100	60	12.5/12.5	7.5
High Use Climbing	100/150	92	12.5/19	11.5

Suggested standards for each zone = the mean of acceptable encounters per day + (preferred encounters per hour * 8) + highest encounters per hour * 8)/3.

current use without knowing if the increase was acceptable to visitors. One important issue that has been learned from this study is that scientific inquiry is needed when defining social standards and should be included, as called for in VERP, in the planning process.

Perhaps the largest limitation in this study was the small sample size. The lone researcher was not able to research all of the wilderness zones and was limited to two survey sites. Each of the survey sites could only be sampled four times throughout the eight-week period. A more complete data collection process would have allowed data to be collected at each site once a week. This would have resulted in larger samples, which would have allowed for comparison of sites within the same zone. Future research should allow for such comparison because it is important that a zone have a consistent meaning, even if it is located in different regions of the Park. In addition, further research should be conducted as the plan is employed to develop an understanding of visitors' reactions to the standards. Future research should become part of the ongoing monitoring that is part of the VERP framework.

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Donations as an Alternative to Wilderness User Fees—The Case of the Desolation Wilderness

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Abstract—Day-use visitors to the Desolation Wilderness were asked about making voluntary donations at the trailhead. Of the 111 visitors who used one of the four trailheads at which voluntary donations were requested, 55% reported making a donation, with an average reported donation amount of $4.20. Subjects were categorized into three groups: donors, would-be donors, and nondonors. Donors had fewer previous visits, and fewer years since their first visit than nondonors. Among donors, higher place attachment was associated with larger donations. Donors and would-be donors perceived significantly more similarity with the Forest Service than did nondonors.

Are wilderness users willing to pay fees to support wilderness management? Recent studies suggest that they are (Lime and Lewis 1997; Watson and others 1998), though not necessarily without some concerns. But while this is an important question to ask, additional relevant questions are: Is it appropriate for users to pay fees? How might requiring wilderness users to pay fees alter the experience being sought? What are some implications of charging user fees? Are there alternatives to mandatory wilderness user fees? This paper examines the potential of using donations as an alternative to charging wilderness user fees.

An underlying assumption in many of the recreation and wilderness user fee discussions seems to be that as long as users are willing to pay fees, then it is perfectly acceptable to charge fees. But a willingness to pay fees and appropriateness of charging fees are distinctly different issues. Users who are willing to pay fees may be showing their support for wild places, but may also be failing to consider all of the consequences of fee programs.

Both scholars and visitors have expressed concerns with charging fees to use public lands for recreation. Concerns are that charging fees may: 1) alter the roles of visitor and agency provider to those of buyer and seller, a relationship less conducive to facilitating the social services role of recreation (Dustin and others 1987; Schultz and others 1988); 2) discourage volunteerism and reduce feelings of stewardship on the part of visitors toward an area (Desolation 1997; Lundgren 1997; Marshall 1994); 3) price some people out of wilderness access (Lime and Lewis 1997; Petersen 1992; Walsh and others 1989; Watson and others 1997); 4) lead to an increased level of management in the area (Desolation 1997); and 5) interfere with or even preclude certain aspects of the wilderness experience, namely feelings of freedom, autonomy, choice and escape (Christensen and others 1998; Cockrell and Wellman 1985; Lime and Lewis 1997; White and others 1995).

Donations may be one alternative to charging wilderness user fees, although little research has examined this alternative. Most research into donation behavior has been in the context of charitable giving (e.g. to non-profit environmental organizations) or blood and organ donation. Donating money to a government agency may be a very different situation, governed by different motives and expectations. Nevertheless, the psychology and marketing literature can inform us about some of the motives for donating, the social norms governing donation behavior, the importance of situational conditions that apply at the time of the solicitation, distinguishing characteristics of donors, and characteristics of successful appeals.

Research that examines donations to support agency backcountry management is limited, but it does suggest that voluntary donations are much preferred over mandatory fees. Godin (1984) found that voluntary contributions were by far the most preferred method of paying backcountry recreation fees. Out of five methods queried (paying for a license, paying a general entrance fee, paying a fee for each specific activity or facility, paying a tax on equipment, or soliciting a voluntary contribution), backcountry recreationists on National Forest lands in New Hampshire and Maine preferred a voluntary contribution by a wide margin; 75% favored voluntary contributions, compared to 50% favoring the next most preferred method (paying a general entrance fee). Only 11% of those surveyed opposed solicitation of a voluntary contribution. Similarly, Fedler and Miles (1989) also found that out of seven common methods of payment, hikers preferred making voluntary contributions by a significant margin (86% to 57% for the next most preferred method, a daily general use fee).

User fees may have multiple purposes. Fees may be collected to generate revenue, to encourage or discourage particular uses or use patterns, to promote personal contact with visitors, to promote equity, or to nurture public support. To the extent that wilderness user fees are being collected to generate revenue, promote equity and nurture public support, donations may be a feasible substitute. But donations may not be a substitute for fees collected in order to encourage or discourage particular uses or use patterns, to promote personal contact with visitors, or if the goal of a fee program is simply to maximize revenue.

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Research on Charitable Giving

Two factors are important to understanding donation behavior: characteristics, attitudes and perceptions of the donor, particularly with respect to the soliciting organization; and effectiveness of solicitation techniques. Donation behavior is deliberate, and the decision to donate hinges on a consideration of costs and rewards (Phillips 1982). When potential donors are asked to contribute, they make fundamental judgements about the soliciting organization—"Is there a need, and how great is the need?" (Smith and Berger 1996, p. 219). Thus, donor awareness of the soliciting organization and perceptions of the organization's function and image are critical. Motivations for charitable giving include reciprocity (the donor has benefited from the organization's activities in the past or anticipates a need for their services in the future), and self-esteem (an attempt to improve one's self-image or perceived social worth) (Dawson 1988). Other donation motives may include peer pressure and a desire to see others benefit (Margolis 1982; Rubin and Thorelli 1984). Donation deterrents include concern over the fiscal responsibility of the receiving organization (Mahatoo and Banting 1988), lack of awareness of the organization, doubts about the worthiness of the cause, and/or lack of accurate information about the organizational mission (Schlegelmilch 1988).

Richer (1995) examined the extent to which donations to environmental organizations may be influenced by a perception that donations may not be needed if an organization receives government funding. He found, instead, that government grants to nonprofit organizations tended to increase private sector donations to that organization, perhaps because donors view government funding as an indicator of the worth of the organization or cause. Whether the same logic might be applied by potential donors to a government agency is unknown.

Another factor in the decision to donate is the extent to which the donor believes the recipient's plight is externally rather than internally caused. Benson and Catt (1978) found that contributions are considerably greater when the recipient's plight is thought to be externally caused. They also found that contributions were significantly greater when the solicitor presents a 'feeling good' justification for giving (e.g. you'll feel good about making a contribution) rather than a 'social responsibility norm' justification (e.g. it's your responsibility to help those in need).

In addition to examining the influence of attitudes on compliance with donation requests, research has also examined the effectiveness of various solicitation techniques. A meta-analysis of 11 experiments on the effect of legitimizing small or "paltry" donations found that, in each case, a larger proportion of subjects made a contribution when a phrase such as "any amount, no matter how small, will help" or "even a dollar (or penny) will help" was added to the solicitation (Fraser and Hite 1989). Although the average dollar amount contributed was smaller for treatment subjects compared with the control group, because of the higher compliance of treatment subjects, total revenue per subject was significantly higher in the treatment group in 7 of the 11 experiments.

Fraser and Hite (1989) found that legitimization of small contributions combined with the promise of a matching contribution was more effective than legitimizing small contributions alone. They posit that legitimization with an actual dollar amount introduces a minimum anchor point that makes modest donations appear more generous and eliminates most non-compliance excuses (e.g. I can't afford to donate). A matching contribution also makes modest donations seem more generous by making them worth twice their face value and heightening the perceived importance of complying.

When donations are requested, the solicited donor often has little idea of the appropriate size of the expected donation. When this is the case, any information available as an initial starting point may be used as an anchor to estimate values, and subjects typically bias judgements in the direction of the suggested anchor (Smith and Berger 1996). A suggested anchor may also influence the solicited donor's choice about whether to make a contribution or not (Brockner and others 1984). Smith and Berger (1996) found that suggesting an anchor increased the rate of compliance with a donation request, and that lower anchors produced higher compliance rates. The size of the suggested anchor did not, however, influence the size of the donation (i.e. lower anchors did not produce lower average contributions, nor did higher anchors produce higher average contributions).

Additional solicitation techniques that may influence donation behavior include the manner in which the solicitation is framed, and the type of reference information provided about the need for the contribution. Smith and Berger (1996) found that positively framed appeals (emphasizing the benefits of contributions to the organization) resulted in higher compliance with donation requests than negatively framed appeals (emphasizing the negative consequences of not raising enough money). When reference information is provided, it may be provided in different forms, such as factual/statistical or narrative/experiential. Smith and Berger (1996) found that the provision of factual, statistical reference information resulted in larger contributions than no information. Likewise, the presence of narrative or experiential reference information yielded larger contributions than no information. There was no significant difference, however, in the size of contributions between statistical and narrative information treatments.

Finally, it appears that reference information about others' contributions may influence donation size. Sell and Wilson (1991) found that contributions to a public good were greater when potential donors had individualized information about how much other individuals had contributed than when they had only aggregated or no information.

Research on Wildlife Tax Checkoffs

Although only limited research has examined voluntary contributions to state nongame wildlife programs via tax return checkoffs, this research is likely the most closely related to the issue of voluntary donations to a government agency charged with managing natural resources. These studies provide insight into why people do or do not contribute to such programs and how contributions could be most effectively solicited.

In Brown and others (1986), lack of awareness was the primary reason given for not contributing to the nongame

wildlife tax checkoff program. Forty-six percent of subjects indicated they had insufficient information on how the funds would be used; 42% said they overlooked the option to contribute; and 17% indicated they were not sure the funds were needed. Donors and nondonors held different beliefs about the outcomes of donations. Positive beliefs (held by more donors than nondonors) included the belief that a donation would lead to a higher quality environment, aid species which would otherwise be ignored, result in improved habitat for nongame species and lead to more recreation opportunities. Negative beliefs (held by more nondonors than donors) included the belief that a donation would leave them (the subject-donor) with less money to buy other more important things, that it would simply contribute to more bureaucracy, and that it would have no effect on nongame species.

Brown and others (1986) recommend that appeals for contributions make clear the uses and ultimate benefits of the contributions, and make potential donors aware that the agency is interested in their opinions as well as their money.

Harris and Miller (1992) found that past donation behavior is a more important predictor than attitudes: soliciting organizations should encourage repeat donations by contacting donors (for example with a newsletter) to thank them and inform them of how the money was used.

Methods

The Desolation Wilderness is a 63,000-acre wilderness located just west of Lake Tahoe in California. Beginning in 1997, the following fees were established under the authority of the Recreation Fee Demonstration Program: $5 for *reserving* an overnight permit; $5 person/night for camping (maximum $10 person/trip and $100 group/trip); $3 per day for day-use parking at one trailhead (Eagle Falls). In lieu of a parking or day-use fee at other trailheads, a donation-request system was established at four trailheads, as well as at several other staffed and unstaffed information stations. Self-service fee tubes were used at the four trailheads to collect voluntary donations. See figure 1 for the text of the sign that accompanied the fee tubes.

Desolation Wilderness Needs Your Help.

Your donation will assist in the management of this unique area. Contributions will be used for education, trail maintenance, and restoration projects.

Donation envelopes may be found in the box below. Please place donations in the envelopes provided and deposit in the tube.

THANK YOU.

Figure 1—Donation sign located at four trailheads.

Watson and others (1998) conducted a study of visitor response to recreation fees in the Desolation Wilderness. Visitors who obtained an overnight or day use permit for the Wilderness between June 1997 and June 1998 were sampled. Names and addresses were collected, and questionnaires were mailed to subjects. Although the rate of compliance for obtaining permits is not known, past estimates have been as high as 90-95% (Watson and others 1998). Day-use visitors were administered a slightly different survey than overnight users. Only day-use visitors were asked about voluntary donations; therefore only these subjects are included in subsequent analyses and discussion. Of the 1264 questionnaires mailed to day-use visitors, 68 were returned undeliverable; 789 completed questionnaires were returned, for a response rate of 66%.

Several questions were asked regarding donations in the questionnaire:

a. Was a donation requested at the trailhead you used? ____Yes (go to b) ____No (go to c)

b. Did you donate? Yes____ How much?____ No____

c. Would you have donated if requested? Yes____ How much?____ No ____

Although only a few questions related to donation behavior were asked, the data collected represent a starting point for further examination of this alternative to mandatory fees. We will first examine general attitudes toward wilderness day-use fees, then self-reported donation behavior. Finally, since there has been no previous research on recreation visitor characteristics or attitudes associated with actual donation behavior, we will explore the association between donation behavior and 1) demographic characteristics, 2) previous use history of the Desolation Wilderness, 3) place attachment and wilderness involvement, and 4) visitors' perceived similarity with the managing agency (Forest Service). These analyses will provide a preliminary understanding of recreation visitor donation behavior.

Results and Discussion

Day-use visitors were asked about paying a fee for wilderness day use. Forty nine percent indicated that paying a wilderness day use fee was acceptable, while 35% indicated that it was unacceptable (16% were neutral). Visitors were asked about paying a trailhead parking fee. Fifty-one percent indicated that paying a trailhead parking fee was acceptable, while 32% indicated that it was unacceptable (17% were neutral). Although 32% of all day-users indicated that paying a trailhead parking fee was unacceptable, at Eagle Falls trailhead (the only trailhead where a parking fee was charged), only 18% of visitors said that paying such a fee reduced the enjoyment of their visit. Visitors may object to paying a fee, but it does not necessarily follow that doing so detracts from their trip enjoyment.

Of the 111 visitors who used one of the four trailheads at which voluntary donations were requested, 55% reported making a donation, with an average reported donation amount of $4.20. Of the 622 visitors asked if they would make a donation were one requested, 77% said they would, with the average intended donation amount again $4.20. However, since the 111 visitors using the trailheads at

which donations were requested were no different from the 622 visitors using the other trailheads on any demographic or attitudinal variables, it follows that the percentage of visitors indicating that they would make a donation is inflated, and 55% of visitors making a donation is probably a more realistic estimate than 77%. Even this 55% figure may be slightly inflated, since it is based on *reported* donations, and there was no mechanism to check the accuracy of those self-reports.

Subjects were next categorized into one of three groups: those who had the opportunity to donate and reported doing so (Donors, n=61, 8.5% of sample); those who had the opportunity to donate and reported not doing so, as well as those who said that they would not donate if given the opportunity (Nondonors, n=181, 25.2% of sample); and those who were not given the opportunity to donate but who said they would donate if given the chance (Would-be Donors, n=475, 66.2% of sample).

No differences were found among the three groups with respect to age, gender, education, or group size. Household income was significantly associated with a propensity to donate, with donors more likely to come from higher income households; however income was not significantly correlated with the *amount* of the reported donation.

Significant differences were found among the three groups with respect to number of previous day trips to the Desolation Wilderness, and number of years since their first day trip to the Desolation (see table 1). Donors reported the fewest previous day trips to the Wilderness, while nondonors reported the most previous day trips. Likewise, donors reported the fewest years since their first day trip, while nondonors reported the most years since their first visit. Day users who have been visiting the longest, and who visit most frequently, are the least likely to donate. And, although there was no significant correlation between reported donation *amount* and number of previous trips or years since first trip, there was a significant negative correlation between *would-be* donation amount and both number of previous trips (Spearman's rho correlation coefficient = –.164; two-tailed significance = .001) and years since first trip (Spearman's rho correlation coefficient = –.122; two-tailed significance = .013). Among would-be donors, those who have been visiting the longest and who visit most often reported a significantly smaller would-be donation amount than those who have been visiting for fewer years and who visit less often.

In order to explore the relationship between place attachment and donation behavior, a series of questions was asked to measure place attachment (place dependence, place centrality, and place identity; see Williams and Watson 1998) as well as wilderness involvement. There were no consistent patterns of association between these measures and donor group membership. However, for donors, the *amount* donated was significantly correlated with place identity (Spearman's rho correlation coefficient = .440; two-tailed significance = .001) and with place centrality (Spearman's rho correlation coefficient = .285; two-tailed significance = .037), but not with place dependence. Amount donated was also significantly correlated with wilderness involvement (Spearman's rho correlation coefficient = .234; two-tailed significance = .091).

Table 1—Mean number of total day trips and years since first day trip to the Desolation Wilderness, for donors, would-be donors, and nondonors.

	Donors	Would-be donors	Nondonors
Total number of day trips to Desolation	6.2[a]	16.4[b]	17.3[b]
Years since first day trip to Desolation	7.6[a]	9.2[a]	12.0[b]

[a,b] Mean values with different superscripts are significantly different at $\alpha = .05$ based on t-test for equality of means.

Finally, since donation behavior is related to both previous use history and place attachment/wilderness involvement, it seemed prudent to examine the relationship between previous use history and measures of place attachment/wilderness involvement, and then examine how these two constructs together may influence donation behavior. All three measures of place attachment, as well as wilderness involvement, were significantly correlated with number of previous visits and years since first visit (see table 2). Together with the previous results, this suggests a complex relationship among donation behavior, previous use history, and place attachment/wilderness involvement. Previous use history is associated (negatively) with propensity to donate, but not with size of donation, while place attachment is associated with size of donation, but not propensity to donate. When visitors are solicited for a donation, they are faced with two decisions—whether to donate, and if so, how much to donate? Previous use history appears to influence the first of these decisions, while place attachment appears to influence the second.

Visitors with a limited use history in the area are more likely to donate than are those with a more extensive use history, but because they are less place-attached they are also more likely to make a smaller donation. Visitors with an extensive use history in the area are less likely to make a donation, but because they are more highly place-attached, when they do donate they tend to donate a larger amount. This suggests that in situations where compliance with donation requests is low (because long-time visitors are not making donations), the agency should design a persuasive message that focuses on visitors' use history (persuading long-time visitors that their donations are needed). However, in situations where compliance with

Table 2—Spearman's rho correlation coefficients for previous use history and place attachment/wilderness involvement.

	Total number of day trips to Desolation	Years since first day trip to sDesolation
Place Identity	.425*	.319*
Place Centrality	.451*	.319*
Place Dependence	.197*	.146*
Wilderness Involvement	.340*	.246*

*Significant at P < .001.

Table 3—Mann-Whitney U-Wilcoxen W test results (Z scores) comparing donors, would-be donors and nondonors on subjects' perceived similarity with the Forest Service.

Group contrasts	The FS shares my values	The FS is like me	The FS has similar goals	The FS supports my views	The FS thinks like me
Nondonors and Would-be donors	–3.372*	–3.536*	–4.718*	–3.821*	–4.511*
Nondonors and Donors	–2.978*	–3.256*	–3.478*	–2.623*	–2.911*
Would-be donors and Donors	–0.949	–1.105	–0.360	–0.339	–0.258

*Two-tailed significance P < .01.

donation requests is adequate but average donation amount is low, the agency should design a persuasive message that focuses on visitors' feelings of place attachment in order to increase average donation amount.

Potential donors' perceptions of the function and image of the soliciting organization are critical. Therefore we explored the relationship between donation behavior and perceived similarity with the managing agency by asking a series of questions to assess the extent to which subjects felt the Forest Service shares their values, is like them, has similar goals, supports their views, and thinks like them. For each of the five questions, a significant difference was found between nondonors and would-be donors, and between nondonors and donors (see table 3). Both donors and would-be donors felt they shared similarities with the Forest Service that nondonors did not feel were shared. No significant differences were found between donors and would-be donors.

Finally, a discriminant analysis was undertaken to determine which of the independent variables best distinguished among donor group membership. The five measures of perceived similarity with the Forest Service, the three measures of place attachment (dependence, centrality, identity), wilderness involvement, total number of previous day trips, years since first day trip and household income were entered stepwise into the analysis, with a required probability of F of .10 to enter. Only two variables were found to be significant predictors of donor group membership, the extent to which the subject perceives that the Forest Service "has similar goals as me," and number of years since first day trip to the Desolation (see table 4).

Conclusions

Past research suggests that donations are preferred over mandatory fees, and the research reported here shows that visitors are willing to make donations—55% of subjects in this study reported donating an average of $4.20. It may be possible to increase both compliance with donation requests and average amount donated with a concerted effort based on research into solicitation effectiveness.

Currently, Forest Service managers at the Desolation Wilderness seem to be more successful at convincing visitors with a relatively limited use history to make a donation. Unfortunately, these newer visitors tend to make smaller donations, perhaps because they have less wilderness involvement in general, and less attachment to the Desolation Wilderness in particular, than visitors with a more extensive use history in the area. By increasing long-time visitors' compliance rate with donation requests, the Forest Service could more successfully tap into the place attachment that appears to translate into larger donations.

It appears that agencies could also increase compliance with donation requests by emphasizing to visitors that they have similar goals. Agencies need to actively encourage repeat donations (by emphasizing the on-going nature of the need and the benefits visitors will realize), since this data shows that long-time and more-frequent visitors are less likely to donate. Day users who have been visiting the area longest, and who visit most frequently, are the least likely to donate; this may be because they have become accustomed to using the area for years without having to pay, while newcomers don't have a long history of free use. As these newcomers (who are already more likely to contribute) continue to visit, repeat donations may be easier to obtain.

A review of research into charitable giving suggests that agencies soliciting donations will have to explain to potential donors not only the need for donations and how the money will be used, but also alleviate some of their concerns regarding the fiscal responsibility of the receiving organization and doubts about the worthiness of the cause. The agency will need to convince potential donors that their donations truly are needed, and that the money contributed will be used responsibly. Two solicitation techniques (reviewed earlier) known to increase compliance with donation requests in non-wilderness contexts are to legitimize small contributions and promise matching funds. Perhaps managing agencies could convince a local or regional trails organization to put up matching funds.

There has been no research into effectively soliciting donations from wilderness visitors, but the situation lends itself well to a controlled experimental design. Independent variables that could be tested in different treatments include: the explanation of the financial need and how the

Table 4—Wilks' λ test results of discriminant analysis predicting donor group membership.

	The Forest Service has similar goals as me	Years since first day trip to the Desolation
Wilks' λ	.964	.947
Equivalent F	10.5*	7.7*

*Significant at P < .001.

money will be used; persuasive messages tapping into visitors' use history versus place attachment; similarity of goals of solicitor and donor; framing of appeals; use of suggested anchors; legitimizing small donations; use of matching contributions; articulating the benefits of donating; emphasizing the fiscal responsibility of the organization; use of various types of reference information; and information on how much money others are donating. Pencil and paper laboratory experiments could be conducted first, followed by field-testing the most promising lab results. A successful donations program may not generate as much revenue as a mandatory fee program, but could meet other goals and still raise a significant amount of money while avoiding engendering negative feelings from visitors.

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The Rise of the Day Visitor in Wilderness: Should Managers be Concerned?

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Abstract—Results of research in Shenandoah National Park Wilderness on the differences between day and overnight visitors to the park's wilderness showed that the two user groups are not as different as originally thought. While the two groups differed somewhat in their level of support for traditional wilderness values, these differences are largely a matter of degree. Promotion of traditional wilderness values through education and regulations may help to strengthen the support and understanding of legally defined Wilderness.

Day visits, as a proportion of all use of wilderness, are increasing (Cole, Watson, and Roggenbuck 1995). Indeed, in many wilderness areas, day visitors exceed half of all visits (Roggenbuck and Lucas 1987), and day use has reached 70% in some areas. Yet wilderness managers seem preoccupied with overnight use and users (Hall 1996). For example, Shenandoah National Park wilderness managers require overnight visitors to have a backcountry permit; day hikers don't need one. In one high-use zone of the wilderness, fear of impacts led managers to forbid overnight camping, but only the size of the parking lot shapes the current amount and kind of day use of the area. At Okefenokee Wilderness, a U.S. Fish and Wildlife area, overnight visitors often must obtain a permit months in advance; overnight stays in the entire wilderness are limited to seven parties per night; camp spots are assigned with a fee of $10.00 per person per night; stays at any given spot can be for only one night; length of stay is limited to four nights per visit and to only two nights per visit during high-use months. At the same time, there is no limitation on day use, permits are not required, and the only charge is a canoe rental fee or a small fee to launch one's private boat. Such regulations suggest that managers are unaware of the high and increasing day use; believe day users' social and ecological impacts are low; and/or believe day visitors' desired, expected, and received experience in wilderness is more appropriate than the overnight experience. In short, it appears that resource managers are favoring the day user in their regulation of wilderness visits.

But are day and overnight wilderness visitors different in the experiences they seek, the impacts they create and notice, and in their preferences for management policies and prescriptions? Many wilderness scholars think so. For example, Ewert (1989) suggests that, while the overnight wilderness visitor typically seeks opportunities for solitude, contemplation, escape, and self-reliance, day users may be simply out for a few hours of exercise in a pleasant setting. However, when researchers have examined data on day and overnight use and user characteristics, findings have been much more mixed.

Some research has suggested that overnight users were seeking a more truly "wilderness" experience, while day visitors emphasized scenery, being with family or friends, or getting exercise in a pleasant environment (Grossa 1979; Roggenbuck, Timm, and Watson 1979; Lucas 1980; Ewert and Hood 1995). But this difference in visit orientation didn't always result in different sensitivities to social and ecological conditions encountered on site. Neither did it consistently explain differences in management preferences. For example, Roggenbuck et al. (1979) found few differences between day and overnight visitors in their perceptions of problems in three wilderness areas in the Southeast. When differences did exist, the overnight visitors were somewhat more likely to notice social impact. Lucas (1980, 1985) and Watson (1993) reported similar results in studies of wilderness visitors in the West. Hall (1996) measured visitor responses to 32 different indicators of ecological and social impacts in three western wilderness areas. She found differences between day and overnight visitors on about one-third of the attributes, and typically the overnight visitors were more sensitive. But with the exception of overnight users' greater sensitivity to human waste and livestock manure, these findings were not consistent across all study areas.

Some research has shown that day users are more supportive than overnight visitors of such conveniences as bridges, toilets, tables, and signs (Grossa 1979). Hall and Shelby (1994) found similar higher support by day users for toilets, corrals, and use of chainsaws in the wilderness. Similarly, Watson (1993) reported that overnight users were slightly more in favor of group size limits, limits on day use, and penalties for entering a wilderness without a permit. In contrast, Yang (1986) found no difference between day and overnight visitors to the Bob Marshall Wilderness in support for group size limits and limits of overall use at overused areas. However, overnight users were less likely to support such restrictive actions as assigned campsites, prohibitions on fire, and restrictions on camping near water. Finally,

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Hall (1996) found that, among regulations that would apparently benefit the wilderness resource and would affect all wilderness users equally, there was little evidence that overnight users give greater support than do the day users.

These mixed findings indicate a need to look more closely at the day and overnight visitors in wilderness. Four issues seem most important: (1) the way the two groups conceive of wilderness, (2) their reasons for particular visits to wilderness, (3) their preferences for wilderness management policies and prescriptions, and (4) the implications of findings on these issues to wilderness management.

Study Objectives

Our study objective for this research was to determine whether there were differences between day and overnight wilderness users and, if so, what these differences were and how they might affect future wilderness management. We chose three research questions to aid us in this process: (1) Do day and overnight visitors define wilderness differently? (2) Do day and overnight visitors have different expectations for their wilderness trip? (3) Do day and overnight visitors prefer different wilderness management practices?

Methods

Study Area

Our research was conducted in Shenandoah National Park (SNP), located in the western part of Virginia. SNP is a 196,466-acre park, of which 79,579 acres, or 41%, is legally designated wilderness. Shenandoah National Park is located near many metropolitan areas, including Washington, DC, and Charlottesville, VA, which helps to keep its visitor population extremely high during the spring, summer, and fall months. Skyline Drive, a scenic parkway, traverses the entire park for 105.4 and provides easy access to the park's several parcels of wilderness. The wilderness areas are also accessed through a variety of fire roads and non-wilderness trails.

Study Population

Our study population was the overnight and day visitors to Shenandoah National Park Wilderness from May 1998 to October 1998. We contacted visitors at 23 wilderness entry trailheads that were stratified by low, medium, and high use, as well as their location on Skyline Drive or the park periphery. The trailheads were stratified and selected through a joint effort of our research team and the National Park Service officials who manage the wilderness areas in this park.

All user groups entering or leaving these trailheads, during our prearranged sampling periods, were given an entry or exit survey. Two people in each group, above the age of 16, were asked to fill out a survey. If there was only one person in a group, that person was asked to fill out only one. Other study participants included those who obtained a backcountry permit from a permit issuing station during our prearranged sampling periods. Two people from each of the groups obtaining a backcountry permit were asked by Park Service officials to fill out a survey. Again, if there was only one person in the group, he or she was asked to fill out a survey.

At the time of contact, it was also determined whether the visitor was a day or overnight user; he/she was then given the appropriate day or overnight survey. Thus, there were four survey types a research technician could hand to the visitor: a day entry form, a day exit form, an overnight entry form, and an overnight exit form. An overnight person was defined as anyone entering the wilderness to stay one or more nights. This was determined by viewing the equipment that visitors had with them and then asking them if they had spent or were planning to spend the night.

Sampling Procedures

Our research at SNP took place from May 1998 to October 1998. During the months of May 1998 to October 1998, two research technicians were in the park sampling visitors on eight randomly selected days each month. Each of the 23 trails was sampled on a weekday and a weekend day during each of the six sampling months. Three sites were sampled each day for 2.5-hour periods. The time of the day in which a particular trail was sampled varied so that each trail was sampled during morning, afternoon, and evening use.

Data Collection Instrument

Study participants were given a two-page on-site contact sheet. Those answering the questionnaire before their trip were asked about their expectations for their wilderness trip, and those answering the questionnaire after trip were asked about their perceptions of their wilderness trip. The categories of questions for the on-site contact sheet included general information about the hike (destination, group size, etc.); questions on crowding and group size; questions on the ideal outdoor recreation area, as well as some personal information, including age and the respondent's gender. We also asked them for their name and address so that we could send them a questionnaire. This mail-back questionnaire included categories of questions regarding crowding, ideal wilderness, ways in which the Shenandoah National Park wilderness should be managed, what types of recreation respondents take part in, other wildernesses they have visited, and some personal information. Our on-site refusal rate was less than 4%, while our mail-back response rate was 50%, giving us a working sample size of 839.

Data Analysis

The data that we collected from both the on-site and mail-back surveys were analyzed by bivariate tests for differences between day and overnight users. When the dependent variable was a continuous or interval-like variable, we used a student's t-test; when the dependent variable was categorical, we used a chi-square test. We checked for equality of variance in our dependent variables, and when the variances were significantly different, we used the pooled variance student's t-test. We are aware of the possibility of

concluding that there were differences between day visitors and overnight visitors when there was none, given the large number of tests run to address our several research questions. In situations where this was most likely to occur, we note and discuss its likelihood in the results sections.

Results

Research Question #1: Do Day and Overnight Visitors Define Wilderness Differently?

To determine whether day and overnight visitors define wilderness differently, we first asked visitors to tell us how familiar they were with the legal definition of wilderness. They were asked to choose between statements that best described how familiar they were with the legal definition and to give a self-evaluation of their knowledge. This question was located on the mail-back questionnaire, and the categories respondents could choose from were: "I have no idea"; " I have heard of wilderness areas, but I don't know anything about the specific definition"; " I know a little about what legally classified wilderness is"; and "I think I know a lot about the legal definition of wilderness."

Figure 1 indicates that by far the largest number of both day and overnight users said they had heard of wilderness areas but knew nothing about their legal definition, or that they knew a little about legally classified wilderness. Very few had no idea about what legal wilderness was or felt they knew a lot. A chi-square did show that, while knowledge was quite low overall, overnight users rated themselves as significantly more knowledgeable than did the day users (Figure 1).

Next, we asked visitors how much 12 specific traditional and nontraditional wilderness characteristics or attributes contributed to their personal image of wilderness. The 12 items, located on the mail-back questionnaire included: "remote from cities"; "gravel fire roads"; " presence of wildlife"; " seeing many other people"; "well-developed, wide trails"; " virgin forest"; "campsites with plant tables and cement fireplaces"; "small farmsteads"; " primitive shelters for camping"; " rugged terrain"; "large, undisturbed tracts of land"; and " campgrounds with RV hookups." The visitors responded to these items with a five-point likert scale ranging from 1, "a big part," to 5, "not a part at all," of their personal perception of wilderness. Through t-test analyses, we found seven significant differences at the $p < 0.05$ level (Figure 2).

Of the seven significant differences, day users felt that five nontraditional characteristics were more a part of wilderness than did the overnight visitors. These attributes included RV hookups, campsite developments, well-developed trails, gravel fire roads, and farmsteads. Day users also felt primitive shelters were more frequently a characteristic of wilderness. But the day users' conception of wilderness also included one characteristic of wilderness, i.e., large, undisturbed tracts of land, at a greater level than did that of the overnight visitors. Perhaps the multi-day visitors are more aware that at Shenandoah National Park wilderness parcels are indeed quite small.

A close examination of Figure 2, however, indicates that, while there are significant differences between the two groups, these differences are small. In general, both groups reported that nontraditional wilderness attributes had little part of their conception of wilderness and that traditional wilderness attributes did define their image.

Overall then, we believe that, while neither group acknowledges much knowledge of the legal definition of wilderness, both groups generally carry an image of wilderness that largely fits common perceptions of wilderness in America. What differences that do exist suggest that overnight visitors have perceptions slightly more congruent with traditional wilderness values.

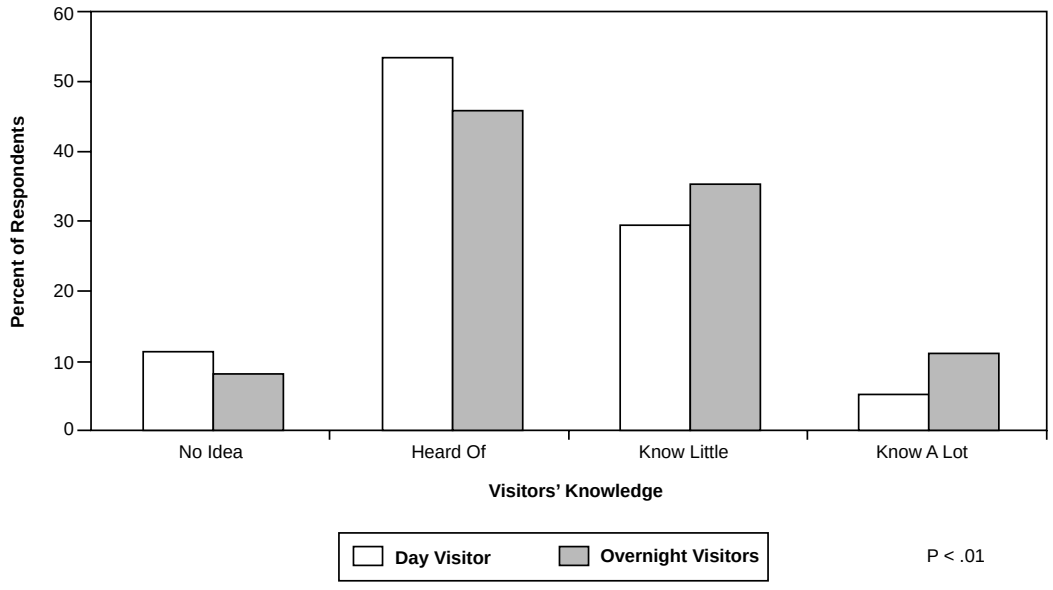

Figure 1—Day and overnight visitors' knowledge of the legal definition of wilderness.

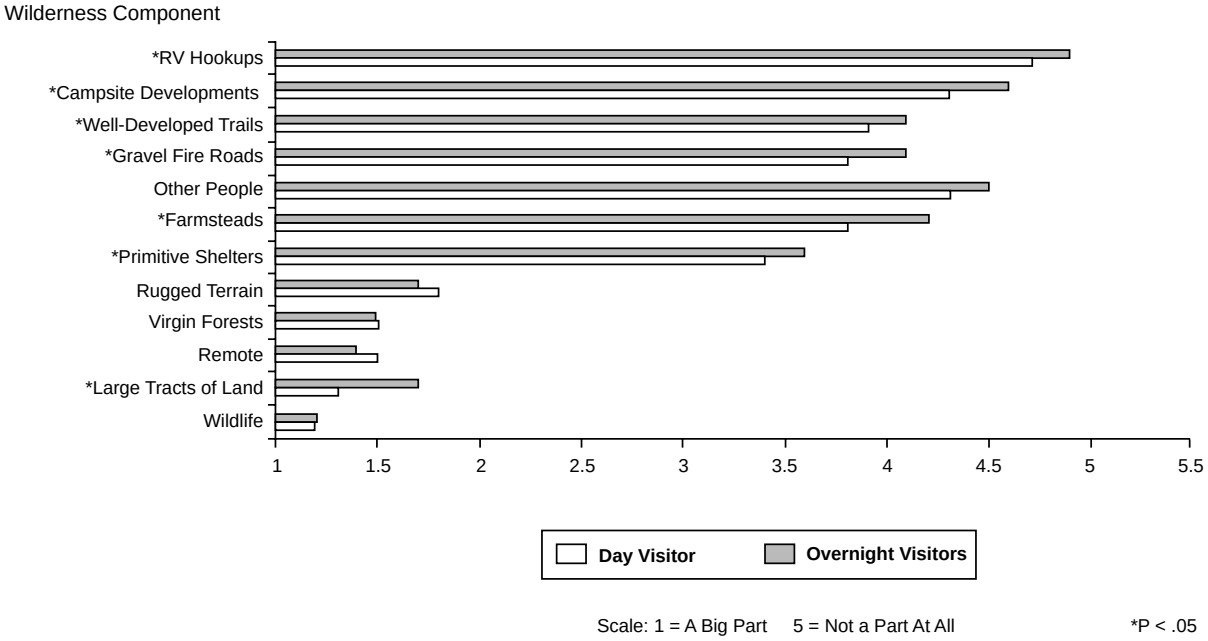

Figure 2—Day and overnight visitors' personal construction of wilderness.

Research Question #2: Do Day and Overnight Visitors Have Different Expectations for This Trip?

Another way to examine possible similarities and differences between day and overnight visitors is to look at their expectations for their wilderness trip. Experience expectations seem particularly important because they likely affect the way visitors evaluate the quality of their trip (Stewart 1989), and managers often seek to manipulate settings and activities to meet expectations (Driver, Brown, Stankey, and Gregoire 1987). We asked respondents about five different primary reasons for going on their trip: "a hike in the woods," "recreation with friends/family," "getting exercise," "viewing scenery," and "a trip into the wilderness." They indicated which type of experience was the most important one for their hike today. A chi-square test indicated a significant difference between day and overnight visitors at the $p < 0.01$ level. These differences seem fairly large to us. As shown in Figure 3, only 10% of day visitors said they were going into the wilderness for an actual wilderness trip, whereas over

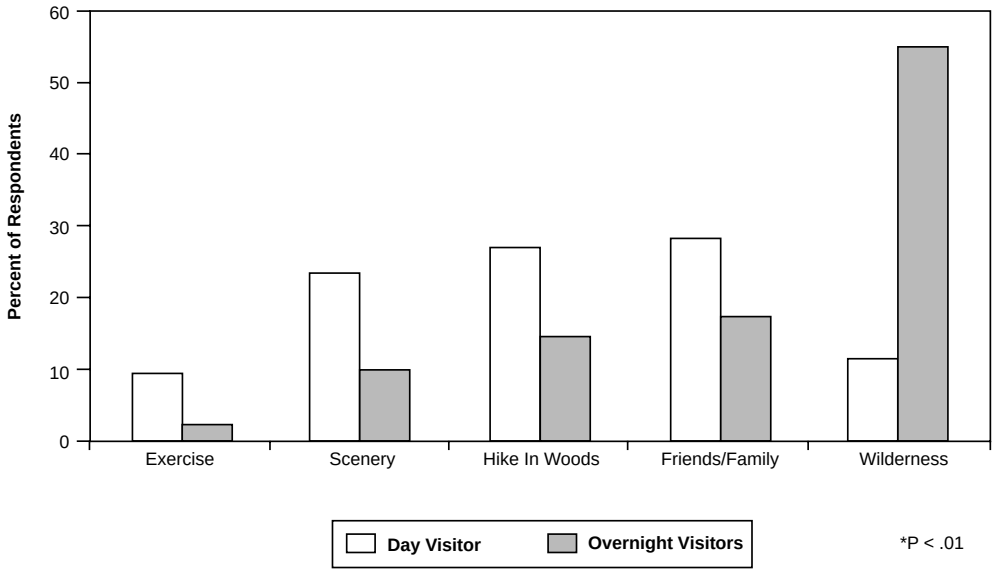

Figure 3—Day and overnight visitors' most important experience sought.

55% of overnight visitors said they were going into wilderness for this reason. Day visitors far more frequently chose "recreation with friends and family," "viewing scenery," and "a hike in the woods" as their primary reason for entering the wilderness. Few study participants went on the wilderness trip primarily for exercise.

We thus begin to see that, while our two study groups don't conceptualize the notion of wilderness very differently, they do have very different reasons for going on the specific visit into Shenandoah Wilderness. Few day visitors see the trip as primarily a wilderness one.

Research Question #3: Do Day and Overnight Visitors Prefer Different Wilderness Management Policies?

By looking at what wilderness management policies both day and overnight visitors prefer, we can get a sense of how visitors want their image of wilderness articulated on the ground. For example, if a particular user group favors more nontraditional wilderness goals or experiences, we might conclude that their actual wilderness values are not as traditional as another user group. Managers could use this information to determine whether and how to meet the goals of various user group, and if and what changes might need to be made in management to satisfy all user preferences.

We first asked respondents to rank seven management goals, with 1 being "most important" and 7 being "least important." The goals that the respondents ranked included: "ensure visitor comfort and convenience," "manage for few (<10) encounters with other groups," "maintain naturally appearing landscapes," "manage for healthy ecosystems," "provide opportunities for primitive types of recreation," "ensure visitors' freedom to go wherever they want with minimal rules and regulations," and "provide physically challenging hikes." After conducting t-tests on these data, we found five significant differences between the two user groups at the $p < 0.01$ level. As shown in Table 1, the two nonsignificant differences included "manage for healthy ecosystems" and "maintain naturally appearing landscapes." Both groups felt that these two management goals were very important to the wilderness. The interesting thing about these results is that even though there were significant differences between the day and overnight visitors, the relative order in which they ranked the goals is almost the same. The exceptions were that the items, "manage the wilderness so that visitors have few encounters with other groups" and "provide physically challenging hikes," were reversed. Thus, even though the two groups differed on several management goals, they ranked their importance in a similar order.

Along with management goals, we looked for differences in our two study groups' support for different management policies. We asked respondents to indicate the extent to which they agreed or disagreed with a list of 14 management policies. Respondents were given a scale from +2, indicating "strongly agree," to –2, indicating "strongly disagree." Data analyses found seven significant differences at the $p < 0.05$ level (Figure 4).

Day users supported more than did overnight visitors the provision of a variety of types of trails to satisfy varied interests and permitting people to carry phones into the wilderness to use in case of an emergency, but both groups supported these policies. Overnight visitors opposed improving and maintaining all wilderness trails at high levels and making moderate improvement in wilderness campsites more than did the day users, but both groups disapproved. In contrast, while both groups disagreed with the policy that "people should not be allowed to carry cellular phones into the wilderness because technology detracts from the wilderness experience" and that "wilderness should have few rules and regulations to ensure visitor freedom," the day users disagreed more. These findings seem interesting not so much because of these differences, but rather because both groups have some unexpected preferences. For example, both groups are in favor of cellular phones in wilderness, an apparent contradiction with traditional wilderness values. Also, both groups seem willing to accept rules and regulations even in the context of the possible loss of visitor freedom.

Table 1—Mean rank of visitors' management goals.

Healthy ecosystems	1.7	1.6
Naturally appearing landscape	2.5	2.4
Primitive recreation*	3.6	3.9
Few encounters*	4.2	4.6
Challenging hikes*	4.7	4.3
Visitor freedom*	5.3	5.6
Comfort and convenience*	6.2	5.6

Scale = 1—most important, 7—least important.

*$p < 0.01$.

The two study groups were also notable in some of their opinions on which they did not differ. For example, both groups disagreed that "there should be no trails and no other human influence at all in wilderness" and "mountain bikes should be allowed in wilderness areas." On the other hand, both day and overnight visitors agreed with the statements: "lightning-caused fires in wilderness should be allowed to burn"; "places in wilderness denuded by fire, insects, or disease should be protected by replanting vegetation"; "heavy infestations of native insects in wilderness should be allowed to run their course"; "hunting should be forbidden in wilderness areas"; and "wilderness managers should be allowed to use chainsaws to clear debris from wilderness trails."

Past research has suggested that recreationists might support general policies that protect the environment, but express different opinions about management actions that seem congruent with those policies but which restrict how they use and enjoy the environment (Noe and Hammitt 1992). Given this, we asked day and overnight wilderness visitors to rate a list of 25 management actions on a scale from 1, "strongly support," to 5, "strongly oppose." We conducted t-tests on these data and found 19 significant differences between the two user groups at $p < 0.02$. Both groups were similar in their general support for the following six items: "limit use in areas where people feel very crowded"; "limit use in areas where biologists feel it is necessary to protect wildlife"; "rather than limiting use, manipulate campsites and trails in subtle ways to make them more durable"; "prohibit campfires (except in fireplaces at huts

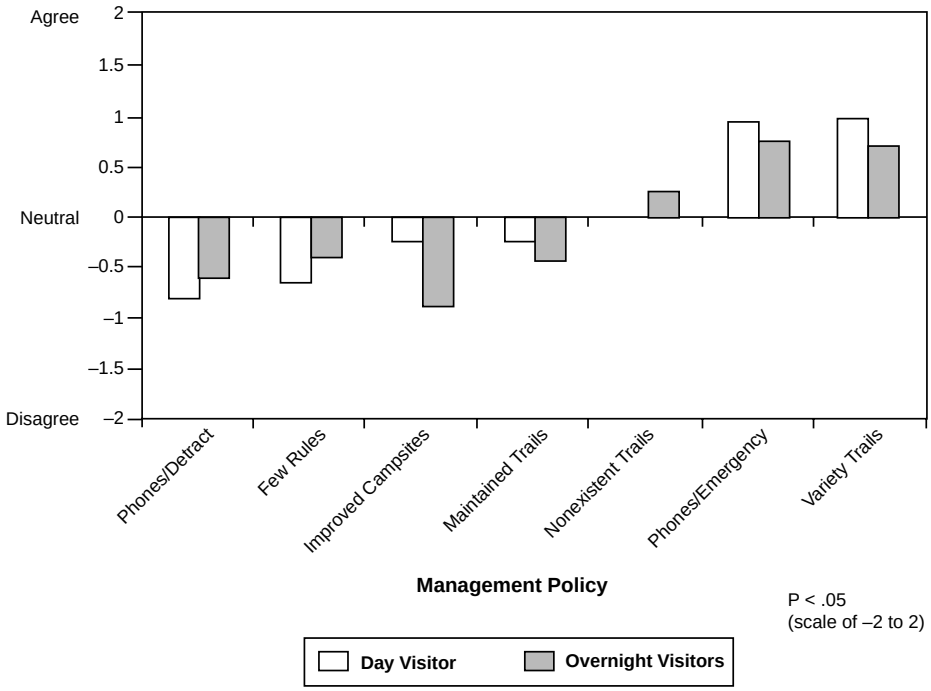

Figure 4—Support of day and overnight visitors for management policies.

and shelters)"; "prohibit mountain bikes on backcountry trails"; and "prohibit camping within $^{1}|_{4}$ mile of Skyline Drive."

Of the 19 significant differences between day and overnight visitors, most were so small as to seem to us to have little managerial relevance. However, seven differed by at least 0.4 on a 5-point scale. Day users were slightly in favor of providing primitive toilets at popular wilderness locations, prohibiting dogs in the wilderness, providing interpretive signs in the wilderness, developing more trails, and restricting camping to designated campsites marked with a post. Overnight users were slightly to moderately opposed to these management actions. Both groups supported limiting group sizes to 10 and closing certain areas to camping because of their value as outstanding natural areas. However, day users favored the camping restriction more than did the overnight users, but the overnight visitors were more supportive of the group size restriction (Figure 5).

Implications and Conclusions

Originally, we had expected many differences between day and overnight visitors in wilderness areas. We thought that the increase of day visitors to wilderness areas could lead to pressures to change the way wilderness is currently managed. However, our research in Shenandoah National Park Wilderness showed fewer differences between the two user groups than expected. Both groups seemed to support the general notion of wilderness. Both day and overnight visitors said that, for the most part, they had heard of the legal definition of wilderness but didn't know anything about the specific definition. Day visitors have somewhat less support for traditional wilderness values, but this difference was surprisingly small. The two groups differ on their overall experience expectations for the specific trip. Typically, the day users were seeking something other than a wilderness trip. The two groups also had somewhat different levels of support for some management policies and actions, but these differences are largely a matter of degree. In the final analysis, both groups valued protecting natural ecosystems and will accept constraints on their freedom to ensure the quality of the wilderness resource.

Our conclusions allow us to suggest certain actions that managers can take to help meet the general expectations of both day and overnight visitors, when they differ as well as when they are similar. Managers of Shenandoah National Park Wilderness need to inform and educate all backcountry visitors about the meaning of legal wilderness. This could, in turn, create a greater appreciation and understanding of what legally defined wilderness is and get more people active in its exploration, protection, and enjoyment.

We also suggest that SNP wilderness managers need to inform both day and overnight visitors that they are entering legally defined wilderness. This suggestion stems from the fact that we believe that many people don't even know they are entering a wilderness on their hike. One way of letting people know that they are in wilderness is by erecting wilderness entry signs along trails at the wilderness boundary. We feel that SNP managers should develop educational brochures about the meaning and values of legally defined wilderness. With the rise of the day use in wilderness, such educational brochures about wilderness would give more people a chance to become more informed about the wilderness idea, wilderness values, and appropriate wilderness behavior.

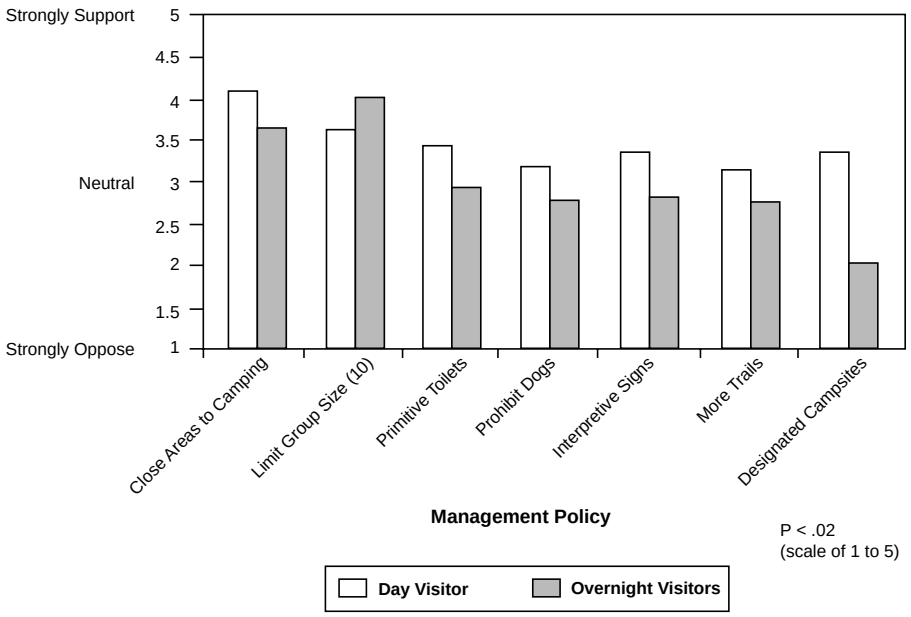

Figure 5—Support of day and overnight visitors for management actions.

Finally, we believe that mangers should expect of day users, and indeed ask of day users, the same knowledge and respect for legal wilderness as they now expect of overnight visitors. Day users almost certainly cause per capita social impacts and "non-camping" ecological impacts at similar levels to overnight users. While somewhat different management prescriptions may be required of day users, we believe that informed day users will be as supportive of actions to protect the wilderness environment and experience as the overnight visitors have been.

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Examining Leisure Event Opportunities of Isle Royale National Park: Bridging the Gap Between Social Process and Spatial Form

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Dorothy H. Anderson
David W. Lime

Abstract—To manage various recreation opportunities, managers and planners must consider the spatial and temporal scale of social process when identifying opportunities on base maps. However, analyses of social process and spatial form are often treated as two distinct approaches--sociological and geographical approaches. A *sociologist* might control for spatial form by adopting landscape zones before examining social process (such as the attainment of solitude). On the other hand, a *geographer* might control for social process (by selecting and studying visitors who attain solitude for example) before examining spatial position of visitors. The two contradictory strategies can lead to very different results. To avoid this contradiction at Isle Royale National Park, leisure event opportunities—a concept that harmonizes both sociological and geographical approaches—were examined during a visitor study.

Recreation providers are given the responsibility to manage various recreation opportunities. In doing so, they must consider both the social process of attaining recreation opportunities (sociology) and the spatial form of the recreational setting (geography). However, the separation of sociology and geography has led to two contradictory management strategies. This paper proposes a way of viewing recreation opportunities as a whole, rather than as separate parts. It recasts recreation opportunities as leisure event opportunities. A leisure event opportunity considers how a visitor perceives *something happening to something* while moving through an environment, and it harmonizes both sociological and geographical approaches to management. To demonstrate how this ecological and holistic approach to planning might work, selected results of an Isle Royale National Park visitor study are presented. More specifically, the purpose of the visitor study was to describe the sociological and geographical characteristics associated with three types of leisure events that were realized by hikers at Isle Royale National Park.

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Past studies have defined and measured four types of recreation opportunities—activities, settings, experiences, and benefits (e.g., Floyd and Gramann, 1997; Manfredo and others, 1983; Stein and Lee, 1995; Virden and Knopf, 1989; Yuan and McEwen, 1989). Taken together, these four kinds of opportunities comprise the recreation demand hierarchy. At the bottom of the hierarchy are activities. Settings occupy the second rung of the hierarchy, and experiences and benefits occupy the third and fourth rungs, respectively. These four types of opportunities also can be configured to illustrate the recreation production process. In this case, activities and settings are considered inputs into the process—they are the elements that managers have some control over; and experiences and benefits are considered the outputs of the production process—they are the physical, social, psychological, economic, and environmental attributes that visitors realize and attain from a recreation engagement.

Problems can occur when recreation providers consider social process (activities, experiences, and benefits) separately from spatial form (settings) during the production of recreation opportunities. The analysis of social process and spatial form are often treated as two distinct approaches and use different languages. For example, sociologists and social psychologists often work in a world without space. They are more interested in social process, such as the realization of solitude experiences. Therefore, when sociologists work at the interface between social process and spatial form, they seek to control for spatial form.

On the other hand, geographers often work in a world where spatial form is critical, but they may fail to understand how spatial form is perceived during social processes. That is, they are interested in describing the spatial and temporal coordinates of an object of a recreational setting. Therefore, geographers may seek to control unwanted social process variables when examining problems that exist at the interface between spatial form and social processes. The results from either approach are often confusing, confounding, and different because they fail to understand how spatial form interacts with social processes (or vice versa). In addition, the results obtained by the sociologist often cannot be translated into the results obtained by the geographer (Harvey 1973).

Recreation planners often control for social process or spatial form when they work at the interface of sociology and geography. Controlling for either of these two variables is one of the most difficult problems created by language inequality. The following examples demonstrate the challenges associated with both strategies.

Strategy 1: Controlling for Social Process. Suppose Area A exists in a national forest, and a geographer has been given the responsibility of managing it for solitude opportunities. To begin, the geographer gathers information from a random sample of visitors recreating throughout Area A. Next, the geographer controls for unwanted social process variables, such as the realization of recreation opportunities other than solitude—excitement or family bonding). *To control for these social process variables, only those visitors who experienced solitude would be included in the analysis.* Finally, the spatial positions of these study participants would be displayed on a map. Assume the geographer finds three different regions or types of spatial form in Area A. That is, 10%, 30%, and 60% of the study participants were reported traveling in regions 1, 2, and 3, respectively (fig. 1). In this example, region 3 would be considered as having the best solitude opportunities because the majority (60%) of visitors who experienced solitude recreated in that area. The geographer might suggest that region 3 provides natural barriers that physically separate visitors and contributes to solitude opportunities.

Strategy 2: Controlling for Spatial Form. Suppose a sociologist was given the responsibility of managing Area A for solitude opportunities. Like the geographer, he/she might gather information from a random sample of visitors recreating throughout Area A. Next, the sociologist controls for unwanted spatial form variables (setting characteristics). *To control for spatial form (setting characteristics), the sociologist would divide Area A into three regions that represent different physical, social, and managerial settings.* (For simplification, assume that the sociologist used the same regions that were identified by the geographer in the previous example.) The sociologist then begins to characterize the visitors of each region with certain properties, such as attaining or not attaining solitude. For example, assume that 25% of region 1 visitors, 50% of region 2 visitors, and 20% of region 3 visitors attained solitude experiences (fig. 2). The sociologist might suggest that social conflict between visitors seeking solitude and visitors seeking other recreation opportunities are minimized in region 2. Therefore, visitors of region 2 (rather than region 3) are more likely to attain solitude—a very different conclusion from the geographer's.

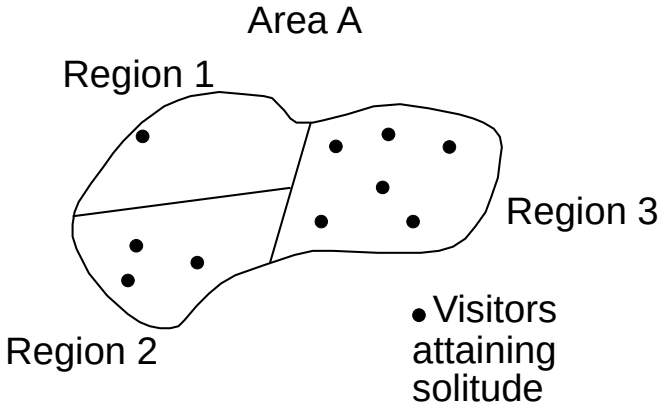

Figure 1—Location of visitors who experience solitude in Area A.

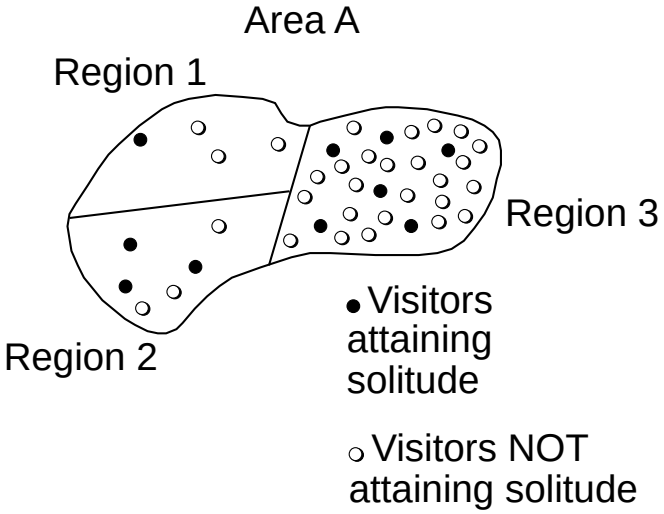

Figure 2—Location of visitors who experience or do not exerience solitude in Area A.

Why did the geographer and sociologist report different conclusions? The difference occurred because the sociological and geographical approaches have distinct languages. The languages were used in different ways and at different times when examining the planning problem: How do we manage Area A for solitude opportunities? The sociologist, who used a social process language, approached this problem by controlling for spatial form very early in the planning process: He/she zoned Area A into 3 regions. As a result, the sociologist was able to examine solitude opportunities in light of social conflict, which made it possible to explain social processes during the later planning stages. On the other hand, the geographer, who used a spatial form language, controlled for social processes during the early planning stages: He/she only examined visitors who experienced solitude. Therefore, the geographer identified three types of spatial form that exist in Area A and was better able to understand spatial form later in the planning process. The final product was the development and explanation of landscape zones.

Harvey (1973) believes that spatial form and social process languages should be regarded as complementary: "The trouble is that the use of one sometimes conflicts with the use of the other. Any successful strategy must appreciate that spatial form and social process are different ways of thinking about the same thing. We must therefore harmonize our thinking about them or else continue to create contradictory strategies for dealing with city problems." That is, there is a need to develop a concept that harmonizes both sociological and geographical imagination in planning.

Theoretical Background

It is necessary to develop a metalanguage that will help recreation providers like planners avoid the problems that exist at the interface of various disciplines. Although Pierskalla and Lee (1998) have discussed a concept (leisure event) that bridges the gap between phenomenology (the world of mind) and physics (the world of matter), it is still

unclear if the same concept is effective at the interface of sociology and geography. "Bridging the gap between the two involves making use of the two languages simultaneously or, preferably, writing some metalanguage which embraces the relevant characteristics of both languages" (Harvey 1973). That is, the metalanguage must be effective so that the results generated in one language can be translated into another as a result of embracing the relevant characteristics of different languages (Harvey 1973). The following review of ecological perception theory suggests that the concept, leisure event opportunities, does satisfy this criterion of an effective metalanguage.

The ecological approach to perception was first presented by Gibson (1950) and flourished through his later work and the work of others in ecological psychology (Shaw and others 1974; Reed 1993). Central to the ecological approach to perception is Gibson's conceptualization of information as ecological—"as special patterns in the energy fields of the environment (not in the organism)" (Reed 1996). For example, the ratios of frequencies and durations of notes (such as the beginning notes used in the song, *Three Blind Mice*) are perceived over time and specify a melody. In outdoor recreation, a visitor might perceive the drumming sounds of ruffed grouse. In summary, the ecological approach suggests that information is perceived as events (or styles or patterns of change). More simply, Michaels and Carello (1981) summarized the words of Shaw and others (1974) and Pittenger and Shaw (1975) when they described an event as *something happening to something* in time and space.

It is important to note that "...both time and space are needed not only for a description of change but also for a description of information that specifies change" (Michaels and Carello 1981). "If events are the significant units of the world, the world must be described in a way that preserves their integrity. The world must be described in terms of both time and space...Time is not chopped into an arbitrary succession of nows, but organized into naturally occurring events of varying duration...Thus, information, like the events it specifies, lasts over time...If information can last over time, so, too, can perception, which is simply the detection of information" (Michaels and Carello 1981). For these reasons, leisure events were used as the unit of analysis in the study presented in this paper. That is, the study controls for leisure events (rather than social process or spatial form) when describing sociological and geographical characteristics of recreation opportunities realized by visitors to Isle Royale National Park.

Methodology

Data were collected at Isle Royale National Park during the summer of 1997. Isle Royale National Park is an island archipelago in Lake Superior, Michigan. It became a national park in 1931. The Park has more than 500,000 acres of land and interior lakes. More than 98 percent of the land area was added to the National Wilderness Preservation System in 1976. In 1980, Isle Royale was made an International Biosphere Reserve. Moose and wolves are among the wildlife inhabiting this remote island. The historical and cultural resources of the island include shipwrecks, fisheries, lighthouses, and abandoned copper mines. Most of the 12,000 to 18,000 annual visitors who travel to the Park arrive by private powerboats or commercial ferries. Developments such as visitor centers, stores, and lodging are located on the east end (Rock Harbor) and the west end (Windigo) of the 45-mile-long island. The two harbors serve as primary landing areas (DuFresne 1991).

In this study, an interview was designed to assess the sociological and geographical characteristics that hikers realized during three types of localized (one-day) events: (1) traveling *to* Windigo, (2) traveling *to* Rock Harbor, and (3) traveling *within* the island interior (away from the developed ends of the island).

The prepositions, *to* and *within*, were used to help operationalize the concept, event, and bridge the gap between sociology and geography. Prepositions are especially useful for explaining spatial relationships. For example, traveling is an activity or social process, and Windigo is a known spatial location. Together, traveling *to* Windigo is something happening to something in time and space.

Study participants were asked to tell their day's story regarding the social process of their leisure activities. To facilitate the story-telling process, study participants were asked to respond to 12 interview questions. The questions are provided below. In addition, study participants were asked to report their day's travel route by drawing arrows on a map. The geographical characteristics associated with the day's leisure event, such as the total number of miles traveled, were determined from this data.

Interview Questions:

- What did you notice happening or existing in the surrounding environment that attracted your attention today? For example, did you notice moose, wolves, birds, weather events, other people, etc. today? If so, what happened or what were they doing?
- How is the environment you experienced today different than the Rock Harbor or Windigo environment you experienced on the first day of your trip?
- What activities did you participate in while in the environment you specified on the map? What did you to today?
- What were you able to accomplish today?
- Why did you choose to participate in these activities?
- How does today's activities compare to other activities such as riding in a car, mountain biking, running, walking, or rock climbing?
- Why did you choose to spend today in the environment you specified on the map?
- What did you get out of your experience today?
- What did this environment mean to you?
- Suppose the events you experienced today were a movie, book, or song, what title would you give it?
- Why did you choose these words for the title of today's events?
- Is there anything else you would like to tell me about today's events?

A total of 76 hikers and paddlers were contacted and agreed to participate in the study. (Less than five visitors declined to participate in the study). One member 16 years of age or older from each party contacted was randomly selected and asked to participate in the study. Visitors were contacted at campgrounds throughout the island. Interview contacts were made in the late afternoon and evening and tape-recorded for later transcription.

The transcribed texts were aggregated for each study participant and examined using a computerized content-analysis technique, Minnesota Contextual Content Analysis (MCCA). This software was used to systematically code word patterns in the open-ended text. MCCA consists of a dictionary of words that accounts for about 90% of English usage. Words in each text were assigned to one of 116 mutually exclusive idea categories. These categories cover a wide variety of general social science interests. MCCA counts each word of a text once. Words with multiple meanings are disambiguated; that is, it looks at how a word is used and, based on the context, assigns it to a category. Scores were calculated for each idea category by taking the difference between the proportion of all words in a text that are in a given category, minus the expected use of the category's words (McTavish and Pirro 1990).

MCCA uses the whole profile of the scores as conceptual calculations of C-scores (or contextual scores). C-scores that are assigned to each text are a measure of emphasis on traditional, practical, emotional, and analytic perspectives expressed in the language. McTavish and Pirro (1990) defined the four contexts:

Traditional Context—A normative perspective on the social situation predominates, and the situation is defined in terms of standards, rules and codes that guide social behavior.

Practical Context—A pragmatic perspective of the social situation predominates, and behavior is directed toward the rational achievement of goals.

Emotional Context—An affective perspective predominates, and the situation is defined in terms of expressions of emotion (both positive and negative) and maximizing individual involvement, personal concern and comfort.

Analytic Context—An intellectual perspective predominates, and the situation is defined in objective terms.

In this study, C-scores represent the sociological perspective of leisure events that were realized by study respondents. A high C-score represents an overemphasis of a social perspective, while a negative score represents an underemphasis.

Results

C-scores and trip characteristics were loaded into the Statistical Package for the Social Sciences (SPSS) and analyzed. Analysis of variance (p - 0.05) and Tukey's post hoc multiple comparison test were conducted to determine if significant sociological and geographical differences exist among the three types of events—traveling to Windigo, traveling within the island interior, traveling to Rock Harbor—that were examined.

The text associated with the three event types differed significantly from one another when looked at from a sociological perspective (table 1). Visitors who were traveling within the island interior during the day expressed a significantly greater emphasis on emotion than those visitors who were traveling to Windigo. However, visitors who were traveling to Windigo expressed a significantly greater analytical perspective than those visitors engaged in other leisure events.

The three event types did not significantly differ when traditional and practical sociological perspectives were examined (table 1).

The type of geographical characteristics realized by respondents significantly differed among the three event types (table 2). Those visitors who were traveling to Windigo hiked significantly farther (mean = 8.7 miles) than visitors who were traveling to Rock Harbor (mean = 6.1 miles). The visitors who were traveling within the island interior hiked an average of 6.9 miles to their campsites.

Discussion

Past studies have defined and measured four types of recreation opportunities—activities, settings, experiences,

Table 1—Comparison of mean C-scores (social perspectives) by leisure event types.

Social perspective	Overall mean	Event type[a]			ANOVA F-test	Fukey post hoc[b]
		1 (n = 14)	2 (n = 44)	3 (n = 18)		
Traditional	-5.0	-3.5	-5.2	-5.8	0.4	
Practical	-4.0	-5.3	-4.9	-1.0	1.1	
Emotional	17.8	9.2	20.0	19.1	4.7[c]	2,3>1
Analytical	-8.7	-0.4	-9.9	-12.3	5.6[c]	1>2,3

[a]1 = traveling to Windigo, 2 = traveling within the island interior, 3 = traveling to Rock Harbor.
[b]Statistically significant at 0.05 level.
[c]Statistically significant at 0.01 level.

Table 2—Comparison of mean number of miles traveled by leisure event types.

mean	Overall	Event types[a]			ANOVA	Tukey
	1 (n = 14)	2 (n = 42)	3 (n = 14)	F-test[b] post hoc[b]		
Miles traveled	7.1	8.7	6.9	6.1	3.2	1>3

[a]1 = traveling to Windigo, 2 = traveling within the island interior, 3 = traveling to Rock Harbor.
[b]Statistically significant at 0.05 level.

and benefits. However, this study suggests that visitors do not necessarily view the four types of recreation opportunities as distinct entities. A visitor often travels through a variety of management zones or settings, engages in more than one activity and has more than one type of experience or benefit during a day at Isle Royale National Park. Realizing this, how can recreation providers distinguish how much the geography of settings (management zones) contribute to the social process of attaining experiences and benefits without creating confusing, confounding, and unreliable results? Also, how can recreation providers know where to implement management actions when the social process of attaining recreation opportunities (as well as the implications of management actions) often goes beyond zone boundaries. For example, reducing the number of visitors entering a trailhead has implications that cannot be easily contained within the spatial boundaries of a management zone. Rather, the management implications have a blurred spatial and temporal scale that more closely resembles leisure event opportunities such as leaving a trailhead on the first day of a trip. As Pierskalla and Lee (1998) suggested, recreation managers can better address these difficult issues if they understand how time and space are related in a leisure setting. Empirical data from this study supports their contention.

The study findings suggest that the three leisure events are distinct recreation opportunities, requiring different management prescriptions. For example, visitors who traveled to Windigo on the last day of their trip traveled farther and expressed a greater 'analytical' perspective. That is, they reported spending a great deal of their time estimating the number of miles that they had left to travel. Apparently, concerns such as wondering whether they have enough water and other supplies to last until the end of their trip and whether they will make it to Windigo in time to catch the ferryboat back to the mainland interfere with their recreational experience. To alleviate the latter worry, managers could provide mileage markers on trails near Windigo to help these visitors better understand where they are. This management suggestion was provided by study participants traveling to Windigo.

> It was a long, hard hike. It was somewhere around ten miles and it was a lot of uphill. It was tough compared to the other two days. It really was a tough hike. If the trails were marked, if there were more markings, I think it would be better. I met other people on the way that said the same thing...they were confused at points because they weren't even sure they were on a trail.

Another study participant said,

> It would be nice to see a sign every once and awhile even if it wasn't a marker. As far as millage goes, just the name of the trail every once and awhile...could [help you] see where you're going.

This study examined a more holistic recreation opportunity—a leisure event. Leisure events were defined as something happening to something in time and space. Rather than clustering study participants, zoning, or using other methods that control for social process or spatial form, this study controlled for leisure events (an ecologically valid unit of the world).

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Response to Conflict Among Wilderness Visitors

Ingrid Schneider

Abstract—Previous conceptual efforts suggest that response to recreational conflict should be framed within an adapted stress-coping response model. An important element in understanding response to conflict is the context of the experience. A basic underlying component of the wilderness experience is privacy, which indicates wilderness visitors are interested in releasing—rather than creating—stress and avoiding distractions; therefore, they are likely to utilize distancing and emotion-focused processes in response to conflict. To explore this idea, over 1,000 visitors to an urban-proximate wilderness area were surveyed during the 1998 season. As expected, visitors utilized emotion- and distancing-focused responses when faced with conflict during their experience. Additional research that specifically examines desires for privacy and other potential factors is suggested.

Recreation-conflict research has focused on understanding the frequency of conflict occurrence and factors affecting visitor perception of conflict. Recent efforts have examined visitor responses to crowding (Hammitt and Patterson 1991; Kuentzel and Heberlein 1992; Robertson and Regula 1994) and conflict (Miller and McCool 1998; Schneider and Hammitt 1995b). Understanding response to conflict is essential because as conflict intensifies, so may coping responses, sanctions and retaliations. Efforts to understand the spectrum of visitor responses are in their infancy, as indicated by the paucity of studies, and further exploration and refinement appears warranted. The purpose of this study was to examine wilderness-visitor responses to conflict.

Recreation research typically identifies three possible visitor responses to recreation crowding: product shift, rationalization and displacement. *Product shift* occurs when the overall definition of the experience changes. Product shift involves both a process and an outcome: a process of change in individual definitions of experiences and outcome changes in overall definition of an area (Shelby and Heberlein 1986; Shelby and others 1988). *Rationalization* involves cognitive efforts to reevaluate the situation more positively. Rooted in cognitive-dissonance theory (Festinger 1957; Heider 1958), rationalization suggests that individuals have a tendency to maintain a state of cognitive consistency. *Displacement* occurs when users leave either the site or area due to an unacceptable change in the social, managerial or resource conditions (Schreyer 1979). Displacement not only requires unacceptable changes, but settings that can be substituted.

Other specific coping responses to recreation crowding have received limited attention by researchers. Williams and others (1991) investigated four responses that visitors used to avoid boats, while Hammitt and Patterson (1991) investigated the frequency with which backcountry visitors used 12 "physical and social" coping behaviors to avoid encounters with others. Kuentzel and Heberlein (1992) explored the recreation-coping phenomena, hypothesizing that increased crowding perceptions would lead from cognitive dissonance-reduction techniques (balancing ideas about what to expect and what actually happens) to intra-site displacement (changing locales within a site) and, finally, inter-site displacement (leaving a place altogether). However, the data did not support their hypotheses. Recreation research is moving toward an enhanced understanding of visitor response to crowding beyond product shift and displacement, but more extensive investigation is warranted due to its still limited nature.

Response to stress has been suggested as particularly applicable in outdoor recreation conflict because as its definition implies obstruction or interference, leading to tension and/or stress. Previous conceptual efforts suggest that response to recreation conflict should be framed within an adapted stress-coping response model (Schneider and Hammitt 1995a), and empirical efforts suggest the framework is suitable for outdoor recreation research (Miller and McCool 1998; Schneider and Hammitt 1995b).

Psychological stress research has been dominated by Folkman and Lazarus' (1980) "ways of coping" (WOC) checklist and questionnaire (WOCQ: 1988). The WOCQ is the result of extensive theoretical effort (Lazarus 1966, 1980; Lazarus and Folkman 1984) and empirical investigations (Pearlin and Schooler 1978; Folkman and Lazarus 1980, 1988). Two major coping processes are problem- and emotion-focused. Problem-focused efforts seek to change the person-environment relationship, while emotion-focused responses manage the emotions association with the stress themselves. Problem- and emotion-focused responses are used together and support each other. The 68-item WOCQ was adapted for use in recreation research (Miller and McCool 1998; Schneider and Hammitt 1995b; Schneider 1995) and shortened to reduce respondent workload and to eliminate seemingly inappropriate items: the modified version contained 22 of the original coping items and eight additional recreation-specific items.

An important element for understanding response to conflict is the context of the experience. Unfortunately, there remains a lack of information on contextual variables in the stress-coping area, despite its critical role. Common characteristics of the wilderness experience include solitude, freedom, naturalness, aesthetic appearance, spiritual values and a mystical dimension (Hendee and others 1978; Stankey and Schreyer 1987). Four important physical properties of

wilderness include an absence of human impact, aspects of forest and vegetation, isolation or remoteness, and solitude (Kliskey and Keasley 1993). Privacy is a broad, basic underlying component of the wilderness experience and desired solitude (Hammitt and Brown 1984). Westin (1967) defines privacy as a claim of individauls or gropus to determine for themselves when, how and to what extent informtion is communicated, while Altman (1975) suggests that privacy is an interpersonal boundary-control process that regulates social interaction. According to Westin (1967), privacy has four functions: personal autonomy, emotional release, self-evaluation and limited and protected communication. These privacy functions, particularly personal autonomy and protected communication, may influence how wilderness visitors respond to conflict. As wilderness visitors are interested in releasing—rather than creating—stress and avoiding distractions as central to their privacy, they are likely to utilize distancing processes. Further, any sort of imposition probably would be kept to one's self rather than shared with others, due to the protected communication. Also, as wilderness visitors are typically alone or in smaller groups, seeking social support and talking with others are not likely to be used. These suggestions are based on the assumption that privacy is a goal for wilderness visitors; however, the actual achievement of solitude warrants additional measurement (Watson and Williams 1995).

Method

To explore this idea, over 1,000 visitors to an urban-proximate wilderness area (30 minutes from a major urban area) in the American Southwest were surveyed during the peak 1998 season. Approximately 25,000 people annually visit the area, based on two trailhead registers and manager experience. Approximately 80-85% of people visit January through April, with 75% of use on weekends. Approximately 90% of visitors are hikers and about 10% are stock users. The amount and type of visitation appears similar to other wilderness areas (Hall and Shelby 1998; Roggenbuck and Lucas 1987). A respondent was systematically selected from every group exiting the trailhead.

The four-page on-site survey included questions and scales focused on visitor (a) stay, (b) activity, (c) conflict perception (dichotomous yes-no measure) and response (22-item coping scale), (d) personal characteristics and (e) socioeconomic and demographic information. A modified WOCQ (Folkman and Lazarus 1980, 1988; Lazarus and Folkman 1984) assessed visitor response to a specific conflict incident. Sixteen items from the most recent version of the WOCQ, ten emotion and six problem focused, formed the base instrument. Six researcher-generated recreation-coping responses completed the 22-item response list. Following Folkman and Lazarus (1985), a four-point scale ranging from "did not use" to "used a great deal" measured response use. The instrument was modified to fit each area and pretested at each location with only minimal changes needed.

Individual coping items were analyzed descriptively to assess the type and frequency of coping response to visitor conflict. Following Folkman and Lazarus (1985), the problem- and emotion-focused items were scaled and the reliability assessed with Cronbach's alpha. Also, three of the six recreation items were combined to form a displacement scale and the reliability similarly assessed with Cronbach's alpha. Individual coping items were analyzed descriptively to assess the type and frequency of coping response to visitor conflict.

Results

Conflict was experienced by 11.8% of wilderness-survey respondents, typically due to litter or inconsiderate others. Respondents who experienced conflict in the wilderness were 59.5% male, with a mean age of 38 years. The majority (51.2%) held a college degree, and 31.2% had an advanced degree. The majority of respondents (87.9%) were Caucasian with an annual household income of $50,000 or more (58.9%). Respondents reported that they were with either family (42.4%), friends (31.8%), alone (15.2%) or with a combination of friends and family (10.6%). The mean number of adults in the group was 2.76. The majority of respondents (58.1%) stayed between one and three hours. The most popular activities for the respondents at the wilderness area were hiking (81.2%) or backpacking (15%).

In the wilderness, 75% or more of respondents indicated that they followed established rules for trail etiquette (91.3%) and didn't let the conflict get to them (79.2%) (table 1). Over 50% of respondents utilized other distancing responses, such as going on as if nothing had happened (70.9%), trying to forget the whole thing (68.4%) and wishing the situation would go away or be over (65.7%). Less than one-third of respondents used problem-solving responses to contend with the conflict experienced (table 2).

Discussion

As expected, visitors used distancing-focused responses when faced with conflict during their recreation experience. Recreation-conflict incidents experienced may not merit the effort necessary to generate problem-solving responses. Alternatively, the privacy functions related to the wilderness experience may have influenced these responses.

Given the consistency of distancing responses to conflict in past (Schneider and Hammitt 1995b) and present research, managers may take solace in knowing that visitors, to a point, do not appear deeply incensed by conflict as indicated by their distancing responses. The managers, in concert with their users, need to determine what is an acceptable percentage of visitors to experience conflict and at what point responses become unacceptable. Often, management techniques are reactive rather than proactive, so monitoring should be considered. For instance, the number of visitors who were intra-site displaced and who considered total displacement as the next alternative should serve as a warning signal. Ensuring available substitutes within a recreation area is one way to keep visitors in an area. However, reducing the source and incidence of conflict is preferred. For instance, litter was a major source of conflict; research indicates keeping an area clean significantly diminishes additional litter (Cialdini and others 1990) so area maintenance may reduce conflict.

An encouraging finding is that visitors frequently resort to following established rules for the area. Thus, effectively communicated etiquette and preferred behavior information

Table 1—Coping response item means and standard deviations (S.D.) for respondents who experienced conflict at wilderness area.

Coping strategy[a]	Wilderness area (n = 133) Mean	S.D.	% use
Followed established rules for water behavior/trail etiquette (R)[b]	2.41	0.91	92.5
Talked to other members of my group about the incident (R)	1.28	1.15	64.2
Wished the situation would go away or be over with (E)	1.20	1.28	54.1
Thought about why the incident occurred (E)	1.16	1.03	65.7
Didn't let it get to me; refused to think about it too much (E)	1.32	0.98	79.2
Tried to forget the whole thing (E)	1.23	1.08	68.4
Went on as if nothing had happened (E)	1.33	1.11	70.9
Refused to get too serious about it (E)	1.19	1.07	66.3
Stood my ground and fought for what I wanted (P)	0.89	1.17	43.3
I tried to keep my feelings to myself (E)	0.81	1.03	47.5
I knew what had to be done so I doubled my efforts to make things work (P)	0.60	1.00	31.9
Expressed anger to the person who caused the incident (P)	0.38	0.76	23.8
I made a plan of action and followed it (P)	0.54	1.03	25.5
Tried not to burn my bridges (E)	0.67	1.08	33.0
Made light of the situation (E)	0.83	1.03	45.9
Kept others from knowing how bad things were (E)	0.67	0.96	39.8
Talked to area personnel about the incident (R)	0.44	0.87	24.2
Came up with a couple of different solutions (P)	0.56	0.98	29.8
Planned to avoid the area on my next visit (R)	0.41	0.82	24.0
Left the area and went to a different part of the area (R)	0.53	0.90	31.9
Tried to get the person responsible to change their mind (P)	0.36	0.85	16.8
Left the area altogether (R)	0.25	0.66	14.6

[a]Measured on a four point scale where 1 = did not use, 2 = used somewhat, 3 = used quite a bit, and 4 = used a great deal.
[b]R denotes recreation coping strategy developed by researcher, E denotes emotion focused strategy as identified by Folkman and Lazarus (1980), and P denotes problem focused strategy as identified by Folkman and Lazarus (1980).

appears to guide visitors and should continue to be a dominant source of information and management implementation. Also, managers may consider innovative methods to communicate with visitors prior to their visit, using the Internet or other alternative sources (Freimund and Queen 1996). Particularly in urban-proximate wilderness areas, where Internet use may be prevalent, such alternative communication mediums are appealing.

The modified ways-of-coping questionnaire is a promising alternative to the measures currently employed to ascertain visitor response to conflict. Initial Cronbach reliability tests indicate the scales are acceptable, but additional work is required for further support. Although 50% of respondents used eight of the responses, the relatively low utilization of some may be a challenge and a consideration for further scale refinement. Also, additional empirical efforts will assess whether more pronounced response differences to conflict exist, whether differentiated by conflict-incident characteristics or personal characteristics. Ipsative investigations, those that study an individual through various situations, might focus on following visitors through a variety of recreational and non-recreational activities and environments to explore the different coping mechanisms employed. While such research will reduce the sample size, the information attained may be quite helpful in understanding the relevance and magnitude of recreational conflict compared to other types of conflict as well as the strength of individual characteristics.

Table 2—Coping response items and scales for respondents who experienced conflict at wilderness area.

Scale/item	Mean	S.D.	Cronbach's alpha
Followed rules	2.41	0.910	
Talked to group	1.28	1.15	
Wished it would go away	1.20	1.28	
Thought about why it happened	1.16	1.03	
Distancing	1.18	0.806	0.82
Confrontive coping	0.83	0.712	0.61
Planful problem solving	0.54	0.788	0.73
Self-control	0.72	0.852	0.76
Talked to management	0.44	0.870	na
Displacement	0.037	0.588	0.65

This research extends the understanding of conflict among wilderness visitors and begins a path toward future work. Additional research that specifically examines desires for privacy and other potential factors is suggested. Of particular interest in wilderness research may be the influence of group size and composition to coping resources. Whether visitors seek social support or keep information to themselves response to conflict seems quite relevant in wilderness conflict research considering the privacy notion. Also relevant is the recognition that wilderness users are not homogenous, and, therefore, comparison among wildreness users by activity style or experience is of interest, as is urban-proximate and urban-distant wilderness visitor responses to conflict. Given the six-fold increase in visitation to the National Wilderness Preservation System (Cole, 1996)

and probable problem intensification, such research seems imminently important. In addition, while it is interesting to describe response to conflict, predictive studies are perhaps more useful for managers who attempt to circumvent increasingly negative situations. In addition, knowledge of the point at which distancing responses are ineffective remains uncertain, yet pertinent for effective management.

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Perceptions of and Preferences for Fee Program Dollar Utilization Among Wilderness Visitors

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Abstract—The purpose of this study was to ascertain visitor perceptions of a fee program and preferences for management utilization of the fee dollars. Differences in program perceptions were examined both by activity and activity style. Wilderness visitors in the American Southwest were surveyed on-site during the 1997–1998 season. Overall, respondents moderately agreed that they knew about and understood the program. Respondents disagreed that the fee would effect their visitation, but they agreed that the program would limit access for others. Visitors most frequently wanted the fees fused or site improvements. As expected, main activity did not differentiate program perceptions, but activity style did. Results indicate that managers need to look beyond visitor activity to the activity's meaning for enhanced understanding of visitors and their perceptions.

Few outdoor recreation issues have been as controversial as implementation of fees for public land use. Although fees have been a component of outdoor recreation for most of this century (Henderson 1997), their prevalence has increased since 1980. The fiscal climate of the 1980s prompted increasing calls for user fee implementation, and managers continued to embrace fee programs in the 1990s. Faced with declining appropriations, increasing operational costs and the desire to maintain quality service, public agency managers have turned to fee programs to recover costs and generate revenue. In 1996, Congress authorized a four-year Recreation Fee Demonstration Program (P.L. 104-1345) to test the effectiveness of collecting fees to help maintain federal recreation resources.

However, critics of fees claim they restrict use by people with lower incomes, serve as a form of double taxation, are inefficient to administer, conflict with the idea of recreation as a merit of good and create an authoritarian, intrusive atmosphere inappropriate to leisure, given its ideal of freedom (Cockrell and Wellman 1985; Dustin 1986; Schultz and others 1988). Fees may also influence on-site behavior and people's reactions to site attributes and management policies (More and others 1996).

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Wilderness managers have a variety of management tools at their disposal, from education through use restriction. Visitor-management techniques are frequently implemented based on manager expertise and preferences, rather than on visitor preferences. This practice appears anachronistic, given the trend toward direct public participation in administrative procedures (Tipple and Wellman 1989). Although the manager conceptually is concerned with management impacts and their effects on visitation patterns (Jubenville 1986), there appears to be minimal visitor input. The purpose of this research was to get input from wilderness visitors about the federal fee program, specifically their perceptions of the program and preferences for fee utilization. Further, differences in fee program perceptions were examined by both activity and activity style.

When deciding among management options, those in charge of resource areas frequently implement tactics based on their own expertise and perceptions or on agency tradition (Fish and Bury 1981). Management decisions appear "to result from personal opinion and, in almost all cases, actions are taken without much preexisting data" (Cole and others 1997). Frequently, discrepancies exist between manager and visitor perceptions. For example, Ibitayo and Virden (1996) found park visitors perceived lower levels of depreciative behavior such as littering and vandalism than park managers. Watson and others (1997) found that visitor groups agreed with manager views regarding the direct and indirect ends of the management continuum, but became less clearly differentiated in its middle.

When research does solicit visitor input on management, it is frequently somewhat limited in scope and format. In theory, user involvement is recognized and recommended for better management and conflict minimization (Cole and others 1997; Moore and Barthlow 1997). However, scarce resources often preclude full visitor involvement. When conducted, management-preference inquiries focus primarily on segmenting visitors by activity type comparing, for example, the attitudes of hikers with horseback riders.

Segmenting visitors by activity type is attractive because of its simplicity and intuitive appeal. However, the assumption that visitors vary dramatically by activity superficially separates visitors and neglects those who engage in multiple activities (Watson and others 1997). Further, the segmentation diminishes the relative importance of each activity to the individual. Recent inquiries suggest less than optimal explanatory power when only activity type is utilized, so considering participation in multiple activities or by strength of activity identity is necessary (Watson and others 1997; Watson and others 1995). Segmenting visitors by their

activity style is one alternative to simple activity separation. Activity style moves beyond simple activity description and incorporates the participants' experience and meaning. Jacob and Schreyer (1980) defined activity style as the various personal meanings assigned to an activity by individuals.

Methods

Setting

The Superstition Wilderness in the Tonto National Forest is located 40 miles east of the Phoenix area. Its 160,000 acres have 180 miles of trail and ranges from 2,000 to 6,000 feet; it is dominated by desert vegetation. The Wilderness is estimated to receive an average annual visitation of 25,000, based on two trailhead registers and manager input. Approximately 80-85% of visitation occurs January through April, with 75% of the visitation occurring on the weekend. Of these visitors, approximately 90% are hikers and about 10% stock users. The amount and type of visitation appears similar to other wilderness areas (Hall and Shelby 1998; Roggenbuck and Lucas 1987). A four-dollar entrance fee is charged at two main trailheads through self-pay fee stations.

Survey

An on-site survey was conducted and was designed to determine several visitor features. This report focuses on visitor demographics (age, gender, income), trip descriptions (length, past visitation, activity), activity style (several Likert items such as, "my activity means a lot to me," "my activity is one of the most satisfying things I do," "a lot of my life is organized around my activity"), perceptions of the fee program on federal lands (several Likert-scale items such as "fees are a good thing") and preferences for fee-program dollar use (forced choice from among personnel, toilets, signs and other). The two-page survey instrument was self-administered on-site at the two trailhead locations that receive a majority of the use. The survey instrument was pretested at the survey sites, few problems were detected, and it was typically completed within 10 to 15 minutes. All groups recreating at the sites were approached, and one person from each group was systematically selected to fill out a questionnaire. The questionnaires were administered on randomly selected sample days from September 1997–August 1998, which included 60% weekend and 40% weekdays. Approximately 20% refused to participate, typically due to time constraints.

Analysis

Descriptive statistics were used to examine the visitors' demographic and activity characteristics, as well as their fee-program perceptions. To examine program-perception differences by *activity,* those in the most frequently reported activities (hiking and backpacking) were separated and their perception means compared with a t-test. The six activity-style items were combined into a scale that demonstrated high reliability (α = .81). To examine program-perception differences by *activity style,* a median split was performed on the activity-style scale and perceptions means compared with a t-test. As necessary, unequal group variances were accounted for by adjusted t-values.

Results

Of the 1,456 respondents, 93.2% were Caucasian, 61.3% were male, and the average age was 41 years. Respondents had either a college degree (46.2%) or an advanced college degree (27.7%). Annual household income was $50,000-74,999 for 26.2% of respondents, $35,000-49,999 for 19.9% of respondents and greater than $100,000 for 16.5% of respondents; the income supported 2.6 people on average.

Respondents typically visited the Superstition Wilderness with friends (38.6%) or family (34.4%) and were in groups comprised of two to four adults (71.5%). Visitors most frequently spent part of one day (91.8%) at the site (an average of 3.5 hours). A majority (55.9%) indicated they spent 10 or more days a year in a wilderness area, averaging 24.53 days a year.

Most respondents reported that their main activity in the Superstition Wilderness was hiking (90.7%). Respondents had participated in their main recreational activity for an average of 14.29 years and had high (45.5%) or very high (28.1%) levels of interest in it. On average, respondents took 10.18 trips a year in Arizona and 4.28 trips outside of Arizona for their main activity. A majority of the respondents (86.4%) agreed to some extent that their main recreational activity was one of the most satisfying things that they did. Similarly, respondents typically agreed (42.9%) that the type of equipment they used in their main activity meant a lot to them. The activity-style scale mean was 3.57 (S.D. =.647, Mode = 3.50), with higher means indicating greater activity style.

Respondents were asked a series of questions to determine their perceptions of the pilot fee program. Of the visitors contacted, almost one-half (45.1%) indicated they were knowledgeable about the fee program, and 56% agreed they understood the reasons behind the fee program. Overall, the respondents disagreed (39.9%) or strongly disagreed (39.2%) that they would *not* return to the area because of the fees. Similarly, respondents agreed (48.7%) or strongly agreed (31%) that they would use the area whether they had to pay a fee or not and the fee program would have no effect on the way they visited the area (57.4%). However, 42.7% indicated that the fees would limit access to the area for some people. Over half (58.0%) agreed that the fee program was a good thing, and two-third (66.7%) agreed that the fees were necessary to maintain the quality of services provided to the public. A majority of the respondents (65%) indicated that they had paid a fee at another area within the region in the past year.

Statistical differences in fee-program perceptions were not found when comparing the two main activity groups (hikers and backpackers). However, activity style did differentiate knowledge and perceptions of the fee program. Those with high-activity style indicated greater agreement that they knew about the program ($t = -6.40$, $p < .001$), they would use the area whether or not they had to pay a fee ($t = -5.09$, $p < .001$), they understood the reasons behind the fee program ($t = -4.31$, $p < .001$), fees were necessary ($t = -2.77$, $p < .01$), and they thought the program was a good thing ($t = -2.39$, $p < .001$).

Neither activity nor activity style statistically differentiated visitor perceptions of the program's effect on their own or others' visits.

Most frequently, visitors indicated fees should be used for signs (41.5%). Toilets were the next priority (26.7%), followed by some other purpose (17.8%). Of the other purposes, maintenance was the most frequently cited. The lowest priority for the use of fees was for personnel (14%).

Discussion

An on-site survey of visitors to a southwestern U.S. wilderness area September 1997–August 1998 indicated moderate knowledge and understanding of the fee program. Most visitors did not anticipate a change in their visits because of the fee program, but other visitors might be affected. Visitors with higher activity style more strongly agreed that they understood and supported the program.

Despite only moderate knowledge of the fee program, the majority of visitors appear to support it and will continue to visit this wilderness area. Thus, concerns about displaced visitors may be unwarranted. For wilderness areas in particular, visitors' relatively high income may minimize the effect of nominal fees. It must be noted that this study did *not* consider visitors who were already displaced and not on-site. Nonetheless, decreases in future visitation are doubtful. Research on previous visitors would delineate any visitation changes more clearly.

Although there is moderate support for the program, improvements are possible. Given the trend toward public involvement and "bridge building" or building relationships with user groups (Chavez 1997), increased public involvement and marketing are suggested. Keeping visitors involved is important to maintaining preferred-recreation opportunities and also continued support and constituency for an area. Public-relation techniques are important to recreation management, and a more proactive approach is suggested (Chavez 1997). Outdoor recreation managers are "typically not formally exposed to recent innovations in services marketing as applied to the management of wildland outdoor recreation" (Capella and Miles 1993). However, customer service and marketing are a key in the increasingly competitive market for consumers and constituents and, therefore priorities for public land managers.

Activity style appeared a more useful variable to differentiate visitor fee-program perceptions than activity. Thus, future management inquiries and research efforts should consider including activity style. A related and more parsimonious measure, revised leisure-identity salience, has been suggested (Winter and others 1998) and successful in differentiating visitor-management preferences (Schneider and Winter 1998), thus it merits attention. Leisure identity salience moves beyond simple activity description and incorporates the participants commitment, reflecting experience and meaning.

At this wilderness site, visitors indicated that fee-program dollars should be used for site enhancements and maintenance more than anything else. As visitor benefits are a high-program priority, such visitor information is useful. Therefore, managers should attempt to incorporate this information within the legislative mandates associated with wilderness. Additional research related to the type, number and quality of signs and toilets is needed. The urban-proximate nature of the wilderness area may be an influence on these results (Ewert and Hood 1995). Comparative research would be of interest to determine if visitors in other wilderness areas need such amenities or if this is unique to urban-proximate areas.

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Effective Coping Strategies in Stressful Outdoor Recreation Situations: Conflict on the Ocoee River

Rudy Schuster
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Abstract—This study was designed to identify conflict situations that cause stress, and predict appraisals of stress, coping strategies and outcomes of the coping process among private boaters on the Ocoee River in Tennessee. Results show that 72 percent of the respondents experienced conflict. Conflict was of moderate intensity and concern, boaters generally psychologically distanced themselves from it, exercised self-control, and in general, satisfaction with the experience was not adversely affected. However, additional statistical analyses failed to identify significant relationships.

Wilderness recreation settings, which receive diverse and high levels of use, often breed conflict among recreationists. Conflict management is becoming a formidable issue for wilderness resource managers as the popularity of resource-based activities increases impacts. Advances in technology have increased the diversity of recreational opportunities, resulting in new activities at sites previously managed for traditional uses. Information about social conflicts in wilderness recreation settings is necessary for managers, who must attempt to mitigate conflict and facilitate user satisfaction.

This study provides information on the nature of conflict experienced by private boaters at the Ocoee River in Tennessee. It should be noted that the Ocoee River is not part of the National Wilderness Preservation System.

Currently, commercial rafters and private boaters, predominantly kayakers, share the Ocoee River. Three separate dams control the water flow in the river. The upper section was the site of the 1996 Olympic whitewater competition; this section of the river has limited dam releases during the year. The middle section experiences dam releases on a frequent schedule throughout the year. There is heavy commercial raft and private boat use of the middle section. When the upper section schedules a release, a smaller number of permits are issued for commercial rafts. There is no limit for private boaters on either section. During 1998, 23,892 commercial rafters paddled the upper section, and 246,787 rafters paddled the middle section. During the same year, 2,823 private boaters paddled the upper section, and 29,620 paddled the middle section. Due to high commercial raft use, the USDA Forest Service constructed a second take-out, exclusively for private boaters, at the end of the middle section, in an attempt to reduce the number of people using the original commercial take-out location. However, many private boaters still use the commercial take-out. The high volume of use on the river is a probable source of conflict.

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Conceptual Background

Stress and Coping

This study used a modified stress-response model (Lazarus and Folkman 1984) to investigate recreationists' appraisal of stressful situations, coping methods and outcomes in the form of satisfaction. Psychological stress is defined as "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well being" (Lazarus and Folkman 1984). Many forces, both physical and social, acting on an outdoor recreationist's psychological state and are perceived as potentially taxing and even threatening, causing increased stress or anxiety (Ewert 1988; Robinson and Stevens 1990).

The stress process conceptualized by Lazarus and Folkman's (1984) model is founded on three assertions. First, stress can result from conditions within the individual and from external situations. Second, there is a mediating appraisal process that includes a primary appraisal and a secondary appraisal. Third, the appraisal process has an effect on the way the individual decides to cope in response to the stress.

The primary appraisal determines if, why and to what extent a particular transaction is stressful. If a situation is stressful, a second appraisal occurs to determine the availability and efficacy of coping options. These two appraisals together determine the type of response necessary. When options are generated, the coping process is initiated, and stress is relieved. If stress is not relieved, the situation is reappraised, and the process begins again. Finally, outcomes are produced as a result of the process. The exact short-term and long-term outcomes are determined by the coping option chosen. Short-term effects may include positive or negative feelings, psychological effects or diminished experiences. Short-term outcomes were measured as satisfaction in this study.

Schneider (1995) and Schneider and Hammitt (1995) used the Lazarus and Folkman (1984) model. They defined outdoor recreation conflict as "a disruptive stressful occurrence

in the visitor's recreation experience involving a person-environment relationship that taxes a person's psychological resources" (Schneider and Hammitt 1995). Their model presumes that outdoor recreation conflict incidents are stressful or produce stress-related situations. Thus, response to conflict likely mirrors the response to stress.

The conceptual foundation of the Ocoee River project is based on the original model of stress and coping developed by Lazarus and Folkman (1984). In the 1995 research, Schneider adapted the stress appraisal and coping process, developed a modified ways-of-coping checklist and used the process in a recreation setting. The methodological operationalization of this research is heavily influenced by the introductory work of Schneider (1995). The definition of stress used in this study is borrowed from that study and recreational conflict is considered synonymous with stress.

Social Support

The general definition of social support, "the resources that are provided by other persons," was used by Cohen and others (1985) and Cohen and Syme (1985). Social support has been conceptualized in two broad categories. Objective support refers to the actual amount of emotional or tangible support provided to an individual. Subjective social support is the extent to which people believe that support will be available should a crisis occur (Coleman and Iso-Ahola 1993).

Two different measures of social support are defined by Cohen and Wills (1985), Coleman and Iso-Ahola (1993) and Iso-Ahola and Park (1996). Structural measures assess the existence or number of relationships. These measures quantify the actual structure of an individual's support network. Structural measures do not provide information about the functions provided by the relationships. Global functional measures assess an individual's perception of the availability of resources. Sarason and others (1990) refer to structural measures as available support. Global functional measures, perceptions or appraisal of available support are more likely to provide a better measure of stress (Coleman 1993; Coleman and Iso-Ahola 1993; Cohen and Wills 1985; Sarason and others 1990). "This is so because the appraisal of stress is based on a person's beliefs about available support as opposed to its actual availability" (Cohen and others1985). This study operationalized social support in terms of appraised support, which is an individual's perception that support is available if necessary.

Social support as it relates to leisure was introduced by Coleman and Iso-Ahola (1993) in a stress-buffering model. The authors state that, "participation in leisure activities provides resources that assist people either to resist the onset of stress reactions or cope with stress before stress has an impact on health." Two methods of coping strategies are listed: (1) Beliefs and dispositions may lead to an appraisal of life problems as non-threatening, and (2) enhancement of people's ability and efforts may alleviate the stress from problematical life events (Coleman and Iso-Ahola 1993).

Coleman and Iso-Ahola (1993) theorized that as companionships are built while participating in leisure activities, an individual's perception of available social support increases. Participation in leisure activities is generally social. One motivation for participation in leisure activities is to establish new friendships or strengthen existing relationships. This rationale is used to hypothesize that participation in leisure activities may produce friendships and contacts that lead people to perceive that they will receive social support when necessary: "Companionships and friendships developed and fostered through leisure engagement help people cope with excessive life stress and thereby help maintain or improve health" (Coleman and Iso-Ahola 1993).

Cohen and others (1985) tested the functional components of social support by operationalizing individual scales measuring appraisal support, belonging support, tangible support and self-esteem support. The authors developed the Interpersonal Support Evaluation List (ISEL) consisting of 40 statements that measure the availability of these four components of social support from a subjects point of view. "Items were developed on theoretical grounds to cover the domain of supportive social resources that could potentially facilitate coping with stressful events" (Cohen and others 1985).

The social support appraisal scale was designed to measure an individual's perception that they have someone to talk to about their problems. The issue of choosing a social support measure for any study is a complex and controversial one. Cohen and others (1985) emphasize that the instrument must provide specific information necessary to answer the question being posed.

Commitment

Buchanan (1985) presents a starting point for the use of commitment in recreation activities. Commitment is defined "as the pledging or binding of an individual to behavior or to the role associated with the behavior and which produce side bets as a results of that behavior...commitment is presented as a process best viewed along a continuum." Buchanan (1985) discusses three components of commitment.

The first component is that the participant must have constant or focused behavior and be willing to reject alternative behaviors. This implies behavioral consistency, responsibility to perform or live up to expectations and the binding of the individual to the activity. The second component is the existence of side bets. A side bet "occurs when something of value (originally unrelated to the present behavior) is staked on maintaining behavioral consistency" (Buchanan 1985). Behavioral inconsistency will result in the loss of a side bet; the threat of loss maintains the consistent behavior. The third component states that there is an affective attachment to an activity or organization through shared goals and values.

Kim and others (1997) cite the work of Johnson (1973), conceptualizing commitment as having two components. Personal commitment, which is similar to affective attachment, is the continued participation in an activity because of moral imperative, inner conviction, hedonistic reasons or intuitive worth. Behavioral commitment is also the result of external constraints placed on the individual. These constraints may be monetary cost or social. Social constraints are a product of sociological phenomena. Cost constraints are associated with the losses that may be incurred due to cessation of participation. These concepts are similar to Buchanan's (1985) conceptualization of commitment.

The process of becoming committed to a recreational activity is associated with the development of the activity as a central life interest (CLI). A CLI is a source of personal reward and a method for developing self-definition. The more often an individual participates in a recreation activity, the more reward they receive. The receipt of reward contributes to the reinforcement of the activity as a CLI. A CLI emphasizes increased personal value for all aspects of the activity (social interaction, skill level, codes of conduct, and equipment). As an activity becomes more of a CLI for participants, they become more susceptible to conflict associated with that activity.

Satisfaction

Level of satisfaction with the recreation experience is an outcome of the stress coping model. Buchanan (1983) stresses that understanding and indetifying the specific psychological benefits that recrationists perceive they are receiving from recreation activities is important for managing and evaluating recreation services. "An understanding of why variation in satisfactions exists between recreation users might ultimately be used to mitigate the potential for conflict" (Buchanan 1983). The quality of outdoor recreation experiences has also been equated with user satisfaction (Manning1986).

Overall measures of satisfaction are often used in recreation research. However, overall measures of satisfaction may not provide the specificity necessary for management decisions. Satisfaction with a recreation experience results from the visitors' perceptions of the actual resource conditions, the managerial conditions and the social conditions (Manning 1986). In order to use satisfaction as an outcome of conflict, satisfaction must be addressed as a multidimensional construct. In addition, the dimensions of satisfaction should be linked to management concerns or the factors that are probable sources of conflict.

Methods

This study was a pilot-test for a future research project. The objective of the survey was to pilot-test the commitment and social support scales for use as components of the stress-coping model.

The present study adopted the appraisal support scale used and validated by Cohen and others (1985). The scale was altered to fit the activity of kayaking.

The commitment scale used in the Ocoee River project was adapted from Kim and others (1997). In the 1997 study, Kim and others designed a nine-item scale designed to integrate the three dimensions of commitment. The scale used at the Ocoee included four additional variables. One variable was designed to measure how serious the individual was about the activity. Another was an additional side-bet measure. The third was a measure of participation consistency. A final addition was a variable measuring amount of time spent thinking about boating.

Satisfaction with the boating experience at the Ocoee River was measured with a scale comprised of variables directly associated with issues identified as probable sources of conflict. The variables were developed after conversations with United States Forest Service managers from the river and boaters who were familiar with the Ocoee River.

Private boaters (predominantly kayakers) were surveyed during a limited dam release of the upper section. The pilot-test sampling was conducted during three weekends in the months of August and September 1998. A convenience sampling method was used. Participants were given a brief introduction and justification for the study, then asked to complete an on-site questionnaire. The three sampling points were the take-out for the upper section, which is also the put-in for the middle section, the commercial take-out for the middle section and the private boater take-out for the middle section.

A total of 252 private boaters were asked to complete an on-site questionnaire. An adjusted response rate of 73 percent produced a total of 185 useable surveys. Commercial raft clients and raft guides were not surveyed in this phase of the study since conflict was anticipated to be greatest for the private boaters.

Simple linear regression was used to determine if (1) level of commitment could predict secondary appraisal, (2) perceived social support could predict secondary appraisal, (3) secondary appraisal could predict coping response, and (4) if coping response could predict satisfaction. Alpha was set at 0.05 for all analyses. Cronbach's alpha split-half reliability coefficient was used to determine the reliability of the scales. A scale was considered reliable with a coefficient of 0.6 or greater. Analyses were conducted using the SPSS 8.0 for Windows statistical software package.

Results

Boater Profile

The average age of the respondents was 34 years; the median was 29. Twenty four percent of the respondents were female, and 71% were male. Seventy-four percent of the respondents had some form of higher education; of these, 21% had some college (respondents were still in college), 39% had graduated from a four-year college, and 14% had graduate degrees. Most respondents were single-not married (46%). The second highest category was married (40%); 1% were separated, and 7% were divorced. The levels of income were: less than $19,000 (15%), $20,000 to $39,000 (19%), $40,000 to $59,000 (20%), $60,000 to $79,000 (11%), $80,000 to $99,000 (5%) and more than $100,000 (20%).

The average group size was four, with three modes of two, three and four (43% of respondents). The average years of experience was 7.62; 49% of the respondents had between two and five years of experience. The average ability level was 3.76 (self reported on a 5 point Likert-type scale, 1 = beginner and 5 = expert), with a mode of 4 (43% of respondents). The average number of days each respondent boated a year was 62, with three modes of 30 days, 50 days and 100 days (a total of 34% of respondents). Ninety-three percent of the respondents had boated on the Ocoee River in the past.

Social Support

Ten variables, rated on a five-point Likert-type scale, anchored with strongly disagree and strongly agree, were

used to measure social support. Table 1 illustrates the scale as it appeared on the survey. Table 2 lists the individual social support variables, their means and standard deviations. The reliability coefficient for the scale was 0.86. The sample mean for the scale was 4.41. In general, the population appears to have a high level of perceived social support.

Commitment

Commitment was measured using the 12 variables shown in table 3. The same scale formatting shown in table 1 was used. The variable, *I consider myself somewhat expert at boating*, was dropped from the original scale. Ability level was measured in a separate variable (five-point Likert-type scale, 1 = beginner and 5 = expert) and would have been included in the analysis twice if retained in the commitment scale. The reliability coefficient (0.90) did not change when the variable "I consider myself somewhat expert at boating" was removed.

Table 3 lists the individual variables, their means and standard deviations. The overall scale mean for the population was 3.39, with a standard deviation of 0.83. A mean of 3.39 indicates that the population was slightly committed to the activity of boating.

Stress and Coping

Primary Appraisal, Intensity, and Concern—Two separate variables were used to measure primary appraisal of stress. One asked if boaters experienced conflict the day of the questionnaire survey; 39% of the respondents experienced conflict that day. The second asked if the boaters had experienced conflict on the river in the past, 69% had. Combining both responses, while accounting for respondents answering yes to both questions, indicated that 72% (n = 34) of the respondents experienced conflict on the Ocoee River. The respondents who experienced conflict were asked if they expected conflict to occur; 54% of these respondents did expect some sort of conflict.

Respondents were asked the level of intensity at the beginning and the end of the conflict experience on a five-point Likert-type scale (1 = very low, 2 =l ow, 3 = moderate, 4 = high, and 5 = very high). Both questions were combined, yielding an average intensity score of 2.96, with a standard deviation of 1.10. In general, the conflict was of moderate intensity.

Concern for the incident at the beginning and end was measured using separate variables on a five-point Likert-type scale (1 = very minor, 2 = minor, 3 = moderate, 4 = major, and 5 = very major). The two measures were combined, for an average concern score of 2.59, with a standard deviation of 0.88. The respondents' concern about the conflict appears to be minor to moderate.

Secondary Appraisal—Secondary appraisal was measured using four variables designed by Lazarus and Folkman (1984). The variables were measured on a five-point Likert-type scale, as illustrated in table 1. Table 4 shows the means and standard deviations for the secondary appraisal variables. The data indicate that the most frequently used secondary appraisal item was "I had to accept it." Accepting the situation suggests that the respondents felt they could not affect the conditions or did not want to affect the conditions.

Ways of Coping Scales—Ways of coping scales were originally organized according to four domains designed by Lazarus and Folkman (1984): confrontive coping, self control, distancing, and planful problem solving (creating plans to actively solve the problem). These variables were

Table 1—Example of survey scale.

	Strongly disagree → Strongly agree				
	1	2	3	4	5
If I stop boating, I would probably lose touch with a lot of my friends.					

Table 2—Social support scale, means, and standard deviations.

Variable	Mean	Standard deviation
There are people I can trust to give me good advice about rivers to paddle.	4.48	0.72
There are people I can trust to give me good advice about difficult situations while boating.	4.47	.80
There are people I can trust to give me good advice about boating techniques.	4.40	.74
My friends and family support my desire to boat.	4.40	.96
I discuss my boating experiences with friends and they discuss theirs with me.	4.34	.82
There is at least one person I know whose advice about boating equipment I really trust.	4.29	.98
If a crisis arose while boating my friends would be able to give me good advice about handling it	4.16	.85
There is someone I could turn to for advice about how to change boating trips while they are in progress.	3.91	1.01
There is someone I can turn to for advice about handling hassles over responsibilities concerning boating trips.	3.67	1.15
There is someone who I feel comfortable going to for advice about stress resulting from boating trips.	3.36	1.20

Note—1 = strongly disagree, 5 = strongly agree, mean = 0.41, sd = 0.63.

Table 3—Commitment variables, means, and standard deviations.

Variable	Mean	Standard deviation
I take boating seriously.*	4.10	1.02
I go boating on a consistent basis.*	3.95	1.10
When I am not boating I am often thinking about boating.*	3.70	1.14
I would rather go boating than do most anything else.	3.69	1.22
Other recreation activities don't interest me as much as boating.	3.49	1.33
I find that a lot of my life is organized around boating.	3.28	1.23
I have put too much into boating to stop now.*	3.14	1.35
If I stop boating, I would probably lose touch with a lot of my friends.	3.02	1.37
Most of my friends are connected to boating.	2.96	1.20
Because of boating, I don't have time to spend participating in other recreation activities.	2.95	1.33
Others would probably say that I spend too much time boating.	2.86	1.38
If I couldn't go boating I am not sure what I would do.	2.77	1.40

Note: alpha =0.90
*Variables not included in the original Kim, Scott, and Crompton (1997) scale.

Table 4—Secondary appraisal variables, means, and standard deviations.

Variable	Mean	Standard deviation
I had to accept it as it was.	3.64	1.35
I could change it or do something about it.	2.71	1.44
I needed to know more about it before I could act.	2.11	1.12
I had to hold myself back from doing something about it.	1.79	1.16

Note—1 = strongly disagree, 5 = trongly agree.

measured on a four-point Likert-type scale, with 1 = did not use, 2 = used somewhat, 3 = used quiet a bit and 4 = used a great deal.

The reliability coefficient for the distancing scale was 0.80. Variables in the distancing scale are shown in table 5. The sample mean for the distancing scale was 2.54, with a standard deviation of 0.95. Respondents chose to psychologically distance themselves from the conflict somewhat to quite often.

A reliability coefficient of 0.6 was not achieved for the confrontive coping, self-control and planful problem solving scales in their original state. However, when three items were added to the self-control scale an alpha of 0.72 was achieved. These items are listed in table 6. The combination of variables still appears to be measuring self-control. It also includes variables from the planful problem solving scale and a variable concerning river etiquette.

Table 5—Ways of coping, distancing scale, means, and standard deviations.

Variable	Mean	Standard deviation
Didn't let it get to me	2.83	1.21
Went on as if nothing had happened.	2.45	1.23
Tried to forget the whole thing.	2.16	1.20
Decided it was not as bad as I thought.	2.27	1.11
Refused to get too serious about it.	2.66	1.21

Note—1 = did not use and 4 = used quite a bit.

With the method of coping implied by this combination of variables, the individual makes a plan to solve the problem; the plan consists of exercising self-control and following established codes of conduct on the river. The sample population mean for this scale was 2.50, with a standard deviation of 0.70. A mean of 2.50, on a four-point scale, indicates that this coping strategy was used somewhat to quite a bit of the time.

The formation of this scale was based on the face value of the variables, intuitive logic and information received during conversations with boaters at the time the survey was distributed. The coping scheme represented by these variables, and discussed above, is plausible and even probable, based on information from boaters at the River. Boaters at the Ocoee indicated that stress and/or conflict is often experienced on the Ocoee as a result of interaction with commercial rafts. The situations they encounter on the river are often perceived as unavoidable. They suggested that self-control was the only option and that it was important to maintain river etiquette, regardless of rafters' behavior. Given that this is a pilot-test, the ad-hoc formation of this scale is justified.

Satisfaction

Nine variables were used to measure satisfaction. The variables, mean ratings and standard deviations are listed in table 7. The variables were measured on a five-point Likert-type scale, as shown in table 1. The reliability coefficient for the scale was 0.88. The sample mean was 3.75, with a standard deviation of 0.77. On a five-point scale, a mean of 3.75 indicates that, in general, the population was satisfied with their experience.

Table 6—Ways of coping, enhanced self-control scale, means, and standard deviations.

Variable	Mean	Standard deviation
Followed established river etiquette.	3.30	0.94
Tried not to damage future boating opportunities with my actions.*	2.81	1.23
I knew what had to be done so I doubled my efforts to make things work.	2.42	1.22
Made a plan of action and followed it.	2.29	1.20
Tried to keep my feelings to myself.*	2.18	1.09
Kept others from knowing how bad things were.*	1.83	1.00

Note—1=did not use and 4=used quite a bit.
*Original self-control variables.

Table 7—Satisfaction scale, means, and standard deviations.

Variable	Mean	Standard deviation
I was satisfied with my interaction with other boaters.	4.18	0.89
I was satisfied with the level of safety maintained on the river today.	3.99	.95
I was satisfied with the number of contacts I had with other people today.	3.98	1.01
I was satisfied with the level of river etiquette excised by other people today.	3.81	1.02
I was satisfied with my interaction with raft clients.	3.78	1.03
I was satisfied with my interaction with raft guides.	3.74	1.10
I was satisfied with the amount of time I waited to access parts of the river.	3.65	1.16
I was satisfied with the amount of space I had to boat in today.	3.50	1.22
I was satisfied with the level of use on the river today.	3.43	1.24

Note—1 = strongly disagree, 5 = strongly agree.

Based on the multidimensional satisfaction scale, the mean satisfaction score for respondents who experienced conflict was 3.70 (standard deviation = 0.68). The mean satisfaction for those who did not experience conflict was 3.88 (standard deviation = 0.80). An independent sample t-test was conducted to determine if the satisfaction levels for each group were significantly different. Levene's test for equal variances indicated that the variances were not equal. The results of the t-test (equal variances not assumed) indicate that p is greater than alpha (alpha = 0.05, p = 0.17, t = 1.36, df = 78), therefore the null hypothesis cannot be rejected. There is no significant difference between the satisfaction levels for boaters who experienced conflict and those who did not.

Inferential Statistics

Standard multiple regression was used to determine if (1) level of commitment could predict secondary appraisal, (2) perceived social support could predict secondary appraisal, (3) secondary appraisal could predict coping response, and (4) if coping response could predict satisfaction. A total of 12 simple linear regression models were tested. Results of the regression analyses revealed that none of the models was significant at the 0.05 level.

Discussion

Despite evidence of conflict in the descriptive data, additional statistical analyses failed to identify significant relationships at the .05 level. Since there were no significant relationships, the stress-coping theoretical models originally proposed could not be supported. Previous research using these instruments and theories in recreation research (Miller 1997; Schneider 1995) and research in other disciplines have produced significant results. The lack of variability in the data, and the inability to find statistically significant results, do not refute the fact that conflict occurred. The high presence of conflict and high level of satisfaction suggest that a number of psychological and coping phenomena may be occurring.

The boater profile indicates that the population consists of experienced boaters (mean = 7.6 years of experience) with a moderate to high ability levels. They participate in the activity on a frequent basis (average of 62 days a year). In addition, 93% of the sample had boated on the Ocoee River in the past. The commitment scale indicated that the participants had a moderate to high level of commitment to the activity of boating. The profile supports this level of commitment by illustrating the high ability levels and frequency of participation. Combined, these measures represent the three dimensions of commitment described previously (behavioral consistency, affective attachment and side bets). However, the measure of commitment was not an effective component of the stress coping model.

The measure of perceived social support was high (mean = 4.41 on a five-point scale). This should be interpreted with caution. The respondents completed the survey in an environment that provided very high levels of social support. They were sitting on the riverbank surrounded by equipment and hundreds of other kayakers and rafters. In this social context, responses may have been biased by the

immediate surroundings. Responses to these measures might be different if the survey were administered in a non-river setting. Statistical analysis indicated that the measure of social support was not an effective component of the stress coping model.

The descriptive data suggest the following coping scheme was generally applied by boaters at the Ocoee. The situation was appraised as stressful. The secondary coping scale indicated that most people accepted the situation as it was. The coping methods chosen were either to psychologically distance one's self from the situation and/or to exercise self-control. The coping strategy worked, and satisfaction with the recreation experience was not adversely affected by the stress.

Despite the high level of conflict incidents reported, the boaters' satisfaction did not suffer. This suggests that the coping responses were effective. One possible explanation may be found in the expectancy measure. Most of the respondents who experienced conflict expected incidents. In addition, 93% of the respondents had been on the Ocoee in the past. This expectation and prior use history may have prepared the respondents for the social, managerial and resource conditions on the river.

Prior knowledge of conditions enhances the predictability of the stress. When a stressful situation is predictable, "functioning [in that environment] is enhanced because one knows what to expect" (Kaplan and Kaplan 1982). By having prior knowledge of the situation, one can be prepared to respond in the most effective manner in order to relieve the stress. In effect, they coped with the anticipated conflict before arriving on-site. In this case, a model attempting to explain coping strategies that occur on-site, and in response to a situation, cannot account for pre-incident coping. This antecedent coping hypothesis is supported, in part, by a second possible explanation.

If past experience contributes to the definition of the setting and recreation experience available at the Ocoee River, and most of the boaters share that definition, it can be considered a shared belief or social norm (Roggenbuck and others 1991). In addition, one of the specific coping methods employed was "followed established river etiquette" (mean = 3.30, sd = 0.94, four-point scale). A mean of 3.30 indicates that respondents employed this coping mechanism frequently. The use of established river etiquette suggests that codes of conduct do exist. Etiquette implies that there are unspoken rules governing appropriate and inappropriate behaviors. Adhering to rules of etiquette is also indicative of normative behavior.

The shared definition and social norm for the experience at the Ocoee River may include stress or conflict. Therefore, if the user adheres to the social norm, conflict will be an acceptable state of affairs. Understanding that conflict will occur and accepting conflict as part of the normal situation support the antecedent coping hypothesis noted above.

Another possible explanation for the high levels of satisfaction, in light of the high conflict, may be found in the concept of cognitive dissonance (Festinger 1957). When cognitive dissonance occurs, the individual makes cognitive adjustments in order to relieve inconsistencies between expected and actual events. While a stressful event may have occurred on the river, the highly hedonistic qualities of the boating may have contributed to the process of dissonance. As a result, the boater may have made adjustments in perception of the experience in order to justify having a difficult time during stressful situations and an enjoyable time while kayaking.

Conclusion

A majority of the boaters who surveyed had experienced conflict on the Ocoee River. This data failed to produce statistically significant results based on the Lazarus and Folkman (1984) stress coping model. However, based on descriptive data, the model did produce a coping scheme that was consistent with reports from boaters on the Ocoee River. Possible explanations for the lack of statistical significance are based on an antecedent coping process rooted in expectation of the conflict and normative beliefs. Methodological adjustments are necessary to account for (1) bias associated with the social support scale, and (2) the use of the Lazarus and Folkman (1984) model to measure antecedent coping, compared with coping after the occurrence of an onsite, stress-causing incident.

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Recreational Kayak Visitor Use, Distribution, and Financial Value of Beaches in Western Prince William Sound, Alaska, Between 1987 and 1998

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Abstract—Visitor use data was collected for the years 1987 to 1998 from sea kayak guide/outfitters, charter boats, lodges and rental businesses operating in western Prince William Sound, Alaska. The majority of the Sound is part of the Chugach National Forest and includes the 2.1 million-acre Nellie Juan Wilderness Study Area, where most recreational use examined in this study is concentrated. Results show that use increased from 6,646 visitor-days in 1987, at an annual rate of 7.5%, to approximately 12,786 visitor-days per season in 1998. Concurrently, gross revenues per beach for guide/operators and charters grew at a rate of 22% annually.

Prince William Sound (PWS), Alaska, is located roughly at 61° N, 148° W and spans a large geographic area of over 4,000 mi^2. The PWS is remote and accessible by road only from Valdez, by train from Whittier, and boat from Cordova, Tatitlek and Chenega. The region is well known for the principal economic activities of commercial fishing and crude oil transportation, but more recently, tourism and recreation activities have increased, with commercial sight seeing tours, cruise lines and sea kayak outfitters now operating in the area. Many of the visitors are drawn by the wild nature and wilderness character of the Sound—huge mountains and glaciers, abundant wildlife and opportunities for solitude.

Although the PWS retains an outstanding wilderness character, the area has a long history of human use, starting with Natives using open boats and kayaks for travel and subsistence (living based on hunting, gathering, and fishing). Today, human activities continue with recreation (hunting, fishing, boating and camping) mining, subsistence and logging all occurring in areas of the Sound. The Chugach National Forest manages most of the uplands, including the 2.1-million acre Nellie Juan Wilderness Study Area. In addition to the National Forest lands, there are State Marine parks, Alaska native village and regional corporation lands, municipal lands, private lands and University of Alaska lands adjacent to the Sound.

The management of visitor use is complicated by the large and geographically complex nature of the region. While there are few access points, there are 4,400 miles of shoreline, of which 2,240 miles are in the Wilderness Study Area. Most of this shoreline consists of rocky cliffs interspersed with beaches consisting of a gray sandstone (graywacke) and slate (Lethcoe, 1990). Upland visitation, in the temperate spruce/hemlock rainforest, is limited due to the boggy nature of most soils above the beaches. The majority of use in the western PWS occurs in the summer months due to the wet, windy and cold conditions between September and April, although hunting may be a substantial off-season use. In May of 2000 a new road will open to Whittier, which is currently served only by railroad. This increased access is expected to result in an immediate and dramatic increase in use from nearby Anchorage, the major population center in the state.

In 1989, the tanker Exxon Valdez ran aground on Bligh Reef and the resulting spill oiled approximately 500 mi of shoreline (Neff, et al. 1995). As a consequence of natural processes and cleanup efforts, little observable surface oil remained two years after the spill (Wiens, et al. 1996), though the long- term effects to the ecosystem remain a controversy some ten years later (Exxon Valdez Oil Spill Trustees 1999). Nonetheless, the cleanup efforts themselves had an effect on the beaches by the introduction of many thousands of workers and boats in areas that had previously received little (if any) human activity and impacts such as the trampling of beach vegetation were observed.

Lack of Data on Recreational Use in Prince William Sound

As with most wilderness areas in the United States, field data on recreational use is lacking in the Sound (Mackey 1998). Some estimates of certain types of use have been made, which are useful for comparison purposes. For example, between 1989 and 1997, sport-fishing in the sound increased at an annual rate of 8%, and tourism in Alaska grew at an annual rate of 10% (Exxon Valdez Oil Spill Trustees 1999). In a summary of use of the National Wilderness Preservation System between 1965 and 1994, Cole noted the average annual increase in use was 6.3% (Cole 1996). Management of recreation by the Forest Service in Prince William Sound has been minimal, limited to recreational cabins and irregular field patrols. Furthermore,

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Forest Service staff have been unwilling to share use information from permitted guides and outfitters, citing confidentiality.

In contrast to the lack of information on visitation, extensive work has been conducted on the degree of campsite impact from recreational use (Monz 1998). To date, campsites at over 100 beaches in the western and northern sound have been assessed for the degree and total areal extent of impact. In general, campsites in PWS tend to fall in the moderately to highly impacted range, showing a high level of cover loss, damage to adjacent trees, and a significant number of additional trails. However, established sites and areas of exposed beach gravel are highly resistant to use and camping exclusively on these areas will limit additional impacts to acceptable levels. This work has established a baseline for monitoring changes in impact as a consequence of future changes in visitor use levels and management actions.

The visitor use study began in 1991 as an attempt to quantify both recreational kayak use and gross revenue generated by kayaking for individual beaches in the western sound from 1987 to the present. Our goal was to quantify recreational visitor days and gross outfitter revenue for specific beaches. In addition, we examined sea kayak use patterns and visitor distributions and obtained a limited amount of data on hunters, U.S. Forest Service cabin users and lodge use. These data are an important contribution to the forest plan revision process currently underway in the Chugach National Forest. The revision will include how many acres the Forest Service will recommend to Congress for designated wilderness. By quantifying the wilderness-dependent use in the Sound, the data in this study can provide a basis for these important land allocation decisions.

Methods

In 1992, use and revenue data for the years 1987 to 1991 was collected from the business records of contributing outfitters/guides, charter boat operators, and sea kayak rental businesses. Starting in 1992, data was collected yearly from operators who willingly contributed for each year until 1998. In addition, we obtained data from one private lodge and the Forest Service public use cabins in the western Sound. Each year, following the season, letters were sent to all known sea kayak outfitters, charter boat operators and lodges in the Glacier Ranger district. Contact lists were developed through Forest Service permittee lists, Alaska Pacific University/Alaska Sea Kayaking Symposium databases, Alaska Wilderness Recreation and Tourism Association membership lists, Anchorage, Whittier and Valdez visitor information services, local stores, and word of mouth. The number of businesses responding varied from year to year as operators went out of business, did not respond or new businesses started. Response rates varied with operator type. All charter boat operators in Whittier supplied information for each year of operation. All Forest Service cabin data was collected and one out of the two operating lodges responded. Due to confidentiality of Forest Service records, no exact yearly number of guides/operators are known, thus no definitive response rate is possible. However, based on our knowledge of the PWS, we estimate that approximately an average 90% of the guides and operators responded each year. Guides/outfitters reported the number of nights clients stayed on specific beaches. Use numbers are based on client numbers, as guides and instructors are not included because the guide/instructor use is not reported to the Forest Service and they do not contribute to the gross revenue of the business. Charter boat operators reported the number of visitors dropped off or picked up at specific beaches per trip. Guided groups that were chartered were counted under the respective guide/outfitter number, not with the charter data. Each night spent or person chartered equaled one Forest Service's 12 hour recreational visitor day (RVD) making two assumptions. The first is that the guided/outfitter users spent some of their time off Forest Service land kayaking each day they traveled between beaches, the other is that charter boat users stayed at least one night at their drop off or pick up beach. We did not attempt to guess where the charter boat users went after they were picked up or before they were dropped off. An estimate of trip length for charter boat users was made by counting the number of days between drop off and pick up for each group. Data were summarized for each beach on a yearly basis.

Forest Service cabin use was added to the RVD numbers. In the western sound there are six public use cabins. The data is reported as number of people per year per cabin (P), number of nights used per year per cabin (N) and number of reservations per year per cabin (R). To determine RVD's an average group size per reservation per cabin was multiplied by the number of nights reserved:

$(P \div R) \times N$ = Recreational Visitor Days per cabin

No analysis of the type of cabin user (that is, whether they travel by sea kayak or power boat) can be done because of lack of data, though sea kayakers commonly use them.

The lodge is a combination of a day lodge and overnight cabins. Since most day use is limited to one to two-hour stays, only overnight use was included, with each nights stay equaling one RVD. A yearly report use was sent to contributing operators to help guide their use for the following year.

Each guide/outfitter also reported the per person rate charged for each trip per year. A per day charge was determined and applied to the use at each site. Charter boat operators submitted their charges per trip which were multiplied by the number of trips per site. Forest Service cabin revenue was figured at $25/night/group (the fee the Forest Service collects per reservation) and lodge revenue was based on per night charges for each year. Where charter boats dropped visitors off at a Forest Service cabin both the revenues were counted, as was revenue from both the charter and outfitter/guide when a guided group was chartered. Each year's data was adjusted by the Anchorage Consumer Price Index for inflation to 1998 dollars. The guide/outfitter use figures were totaled by individual beach.

This study looked at recreational sites of three types: camping beaches, Forest Service cabins and one private lodge. Although most recreational use in the sound takes place on the water, one significant use of the uplands is overnight camping by sea kayakers, hunters and others on beaches above high tide. Camping beaches were identified by the outfitters/guides and charter boat operators, the author's personal experience on the sound over the past 15

years, the campsite assessment study (Monz 1998) and historical information from the National Outdoor Leadership School. Though camping may exist at some beaches not reported in this study, our personal experience and the findings of the campsite study (Monz 1998) indicate that this use is probably minimal. Beaches in the eastern part of the sound were not included as guide/outfitters and charter boat operators did not report any use in the area for the duration of the study. Although some visitors do travel in the eastern part of the Sound, lack of any reported data confined this study to the western areas.

In the summer of 1998, a count of kayakers arriving in Whittier by train (the only current access in Whittier) was completed to determine a ratio of nonguided and nonchartered use to guided/chartered use. During the months of June, July and August trains were met according to a schedule designed to meet a sample of approximately 22% of the trains arriving in Whittier. The observer recorded the number of double, single, and folding kayaks, the number of people associated with the kayaks, and the number of people associated with rental and/or guided groups. The sampling procedure was designed to meet every train an equal percent of arrival times each month. Charter figures indicate that visitor use numbers were consistent over the days of the week.

The total observed use for each arrival time was averaged per month for an average number of people per train. For the months of June, July, and August the average number of people for each arrival time observed was extrapolated to the whole month by dividing each total by the proportion of trains met for each arrival time as follows:

(total number of people per train per month observed ÷ number of trains observed) ÷ proportion of trains observed per month = total use per month by train.

Since no trains were observed in May or September, we estimated use for May and September by 1) calculating a summer monthly average by totaling use for each train for June, July, and August and dividing by three, and 2) multiplying the summer average by a factor of .33 for May and .16 for September to estimate visitation during these months. These factors (.33 and .16) are the proportion of sea kayakers served by charters during May or September compared to the average number served during the summer.

For this study it was assumed that the ratio of guided versus nonguided use exists as charter versus noncharter use. To use a different ratio creates the possibility of double counting nonguided kayakers. We estimated total use for all years using the proportion of non guided/ nonchartered to total visitors observed in the 1998 Whittier study and increasing the available guide and charter numbers accordingly. This assumes that the ratio of charter versus noncharter use that we determined in 1998 has stayed the same over the previous 12 years. Forest Service cabin and lodge use was not corrected as it is assumed that those figures capture all use at those locations.

Results

With 11 years of data collected, 282 sites have been identified as either camping beaches, public use cabins and one lodge. It was estimated that 2,433 individual kayak visitors used the Whittier train, the only access to and from the western sound, in the summer of 1998. From charter boat use figures, we know that 2,054 kayakers used charters, leaving 379 visitors not using charters, or approximately 18% of the charter use. The results of both the use and the revenue studies show consistent growth of use in western Prince William Sound between 1987 and 1998 (table 1). Recreation user days grew at an average annual rate of 7.5%. Dips in use during 1989 can possibly be attributed to the negative publicity from the Exxon Valdez Oil Spill. Use quickly rebounded in 1990, indicating that the effect from the spill on visitation was temporary. Other year to year changes in use can be attributed to a varying number of guide and charter operators, possible effects of a tourism boycott of tourism due to the State of Alaska's wolf control program (1992/1993), and the anticipated opening of the Whittier road. These effects are anecdotal and would be worth more analysis and study.

Out of the 282 sites in the study, the six Forest Service cabins had 35% of the total use, camping beaches 60%, and

Table 1—Recreational visitor days by use sector and year.

Year	Guided use	Chartered use	F.S. cabins	Lodge	Total counted[1]	Estimated total[2]
1987	3340	191	2479	0	6010	6646
1988	3035	310	2173	0	5518	6120
1989	1651	401	2104	0	4156	4525
1990	3005	754	2233	0	5992	6669
1991	3884	894	2579	0	7357	8217
1992	4342	822	2504	0	7668	8598
1993	2755	948	2932	0	6635	7302
1994	2782	1500	2681	0	6963	7734
1995	3027	1523	3078	0	7628	8447
1996	2368	1527	3403	400	7698	8399
1997	3877	2293	1835	1200	9205	10316
1998	5256	2482	2150	1505	11939	12786
Overall totals	39250	13645	30151	3105	86223	95672

[1]Sum total of all use measured.
[2]Overall estimated total including nonguided/nonchartered use = [(Guided + Chartered) x 1.18] + (Lodge + F.S. Cabins).

the lodge 3%. The location of the remaining 2% is unknown due to outfitters who were unwilling or unable to specify exact locations of their camping sites. Forty-six percent of the total known use occurred on just one quarter of the beaches with the remaining beaches having just 15% of the known use. When analyzed by Forest Service planning area, 18% of the areas have 60% of the use (table 2). Total use of specific beaches tends to decrease as total round trip distance from Whittier increases ($r = -0.26$, $p < 0.001$, fig. 1).

Using a 18% multiplier for nonguided/nonchartered use, but not Forest Service Cabin and lodge use, the total recreational visitor days for 1998 is 12,786. If charter use is multiplied by the average trip length of 6.5 days per user, RVD's for 1998 jump to 26,194. If the same average charter trip length is applied to all years of the study use, the use increases by an annual rate of 20%. This is, however, speculative because it assumes that the average charter trip length stays the same from year to year.

Total revenue has also increased (fig. 2), with annual average growth of 22% between 1987 and 1998. Revenue for 1987 was $318,013 and increased to $1,092,536 in 1998 with the sum total for the period between 1987 and 1998 being $5,508,405. The rapid growth of revenue in 1997 and 1998 can be attributed to the increase in operator rates, increased kayak rental businesses, and the dramatic increase in lodge guests. These results can be looked at as an estimate displacement costs per beach. For example, if a mariculture operation applies for a permit at Meares Point, effectively displacing camping use, operators would potentially lose $10,600 per year if no nearby beach were to be available.

Analysis of drop-off and pick-up data indicates that the average charter group size was 4 people and average trip length was 6.5 days for 1998. Although length of wilderness stays seem to be decreasing in the lower 48 (Manning 1985, Hammitt and Cole 1998), this may not be the case for Alaska where the remote nature of the wilderness areas often results in higher access costs. Nonresident visitors, in particular, may prefer to stay longer as a consequence.

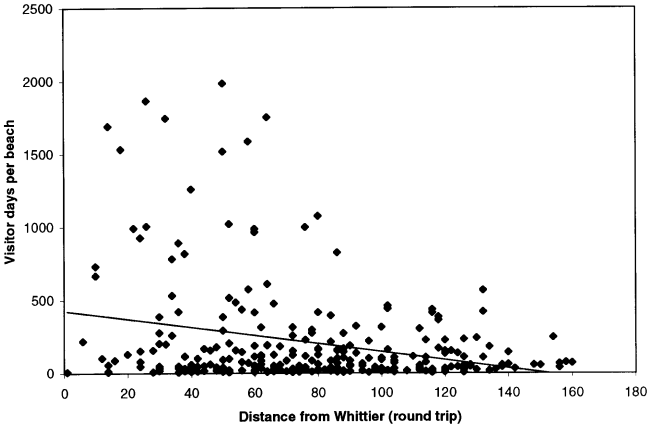

Figure 1—The relationship between total visitor use days and the round-trip distance from Whittier to individual beaches.

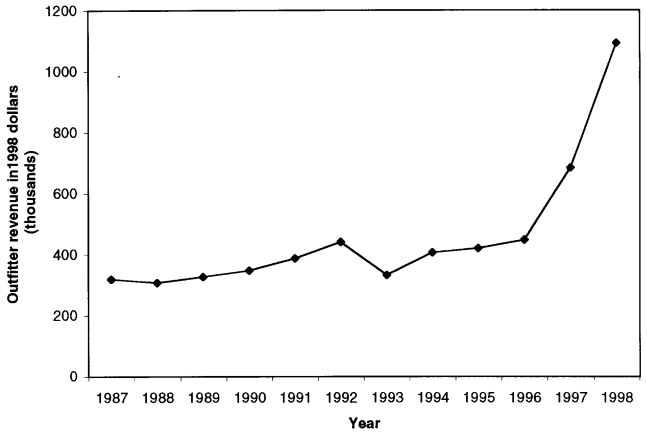

Figure 2—Total reported revenue from outfitters and guides for 1987–1998.

Table 2—Visitation by Forest Service area.

F.S. area	1987	1998	Percent change	Cumulative use (1987-98)[1]	Percent of total[2]
Culross Passage	1195	1461	22	17375	18
Barry Arm	593	882	48	9867	10.2
Bettles	492	817	66	8744	9
Passage Canal	485	847	74	7139	7.4
Lower Cochrane	475	389	-18	6297	6.5
Lower College	422	428	1	5141	5.3
Blackstone Bay	57	498	774	4070	4.2
Surprise Cove	162	340	109	3520	3.7
Glacier	16	1529	9456	3479	3.6
Nellie Juan	197	493	150	3363	3.5
Eshamy	333	187	-43	2875	2.9

[1]Overall estimated cumulative use for the period using correction for nonguided/nonchartered use.

[2]Use as a percentage of corrected total which included nonguided/nonchartered use. Destinations of nonguided/nonchartered visitors are unknown and therefore these percentages are probably an underestimate.

Discussion

This study is an initial effort in understanding recreational use in Prince William Sound. The beach by beach data provides useful information for land managers as they make decisions on what type of use should be allowed and how it is managed. As use in the Sound increases, managers should be aware that certain beaches and areas have most of the sea kayaking use, and it is arguably appropriate to manage these areas for these kind of experiences. Furthermore, development attracts use and encourages more use by those who want the amenities provided. The same development, however, changes the nature of the area and may have unforeseen side effects. The limited number of beaches that have adequate campsites suggests that managers should consider concentrating development to beaches that are not adequate for camping, thus maintaining the number of available campsites.

This study has certain limitations:

- The Chugach National Forest has been unwilling to share permittee user or revenue numbers citing confidentiality. Therefore the exact number of outfitters and guides operating in the area is not known.
- Some operators have been unwilling to share their client and revenue numbers.

As with many studies of wilderness use (for example, Cole 1996), measuring nonguided, private use is a significant challenge.

These limitations suggest that our revenue and use numbers are probably underestimated. Further studies are needed to eliminate some of the assumptions in this work. A more thorough examination of current use and patterns of nonguided and nonchartered use to determine group size, destinations and length of stay would be very useful. The study should also be expanded to all of Prince William Sound, especially the eastern Sound, where use may increase as the tourism and kayaking industry matures.

By applying the Forest Service fee structure to the revenue figures, an estimate can be made as to the amount of fees paid to the Forest Service by outfitter/guides for permits by beach and/or area. This can provide an estimate of the fee generation value of the current Wilderness Study Area has to the Forest Service. Though the Forest Service has data per permittee, they do not have data per beach or area. Since charter boat operators don't use Forest lands, they do not have Forest Service permits. Without including charter, Forest Service cabin or lodge figures, and using the 3% of gross figure used to determine permit fees, permittees could have paid a total of $22,078 to the Forest Service (3% of $735,941) for 1998. Cabin revenues add another $49,012. Without complete guide and outfitter figures, this number is undoubtedly low. The point is made, however, that the Wilderness Study Area does have some economic value to the Forest Service, and that value is increasing with increasing wilderness use.

The most useful information in this study is the percent of growth in visitation and the distribution of use. Although new data from the Forest or reluctant operators would increase the actual numbers of use and revenue, the estimated sample of contributing guide/outfitters is high enough that the overall percent of use and distribution would probably not change dramatically. The observed trends suggest that the growth of sea kayaking will likely continue, barring catastrophic events (such as an oil spill) or if activities that displace wilderness visitors are allowed to expand considerably. Moreover, the opening of the Whittier road in the year 2000 will also contribute to the growth of kayaking as the area becomes more accessible to visitors. This will provide an opportunity to study changes in visitor use as a result of a dramatic change in access. Our observations indicate that some increase in use may already be occurring as users who value wilderness characteristics visit the Sound before the road opens.

Surveys done as part of the state's most recent State Comprehensive Outdoor Recreation Plan indicate that sea kayaking is the third most likely activity that respondents would want to try next year if they had the opportunity (Alaska Department of Natural Resources 1998). This indicates the potential continued growth in interest in sea kayaking among residents. In addition, if tourism in Alaska continues to grow, nonresident use of the Prince William Sound is likely to also increase. As a consequence, the revenue generated from guide/outfitter fees for the Forest Service will continue to rise if the wilderness characteristics that the operators and their clients value are maintained.

Conclusion

This study has attempted to quantify the extent of visitor use in western Prince William Sound between 1987 and 1998. The use of PWS by sea kayakers has increased 7.5% per year over the past 12 years, with dramatic increases in the past 2 years. Outfitter/guide revenue has grown faster at an average annual rate of 22%. With the increase in recreational use and related economic value, Prince William Sound needs careful management of its wilderness characteristics. The value and extent of wilderness recreation is significant in the Sound and arguably justifies management of the Sound to this end.

Acknowledgments

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Visitors' Relationship to the Resource: Comparing Place Attachment in Wildland and Developed Settings

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Abstract—Emotional/symbolic and functional place attachments were measured on the Green and Colorado Rivers in Canyonlands National Park and at Mount Rushmore National Memorial. Although Canyonlands and Mount Rushmore represent very different recreational settings, it was possible to measure both types of attachment by using 12 place attachment statements. In Canyonlands, river users on the Green and Colorado Rivers demonstrated different motives for taking a river trip and different levels of acceptance for potential management actions, based on respondents' level of agreement with place attachment statements. Compared to river users with relatively high agreement on the Colorado River, Green River users with relatively high levels of agreement indicated a stronger desire for wildland experiences.

Sense of place, also referred to as place attachment, has been recognized in disciplines such as geography and architecture since the early 1970s. In recent years, place attachment has gained increasing scientific interest in the field of resource management (Williams and Stewart 1998; Moore and Graefe 1994; Mitchell and others 1993). This study sought to show the potential utility of place attachment as a resource management tool. Specifically, the intent was to show an ability to measure place attachment in different types of recreational settings: a backcountry setting (Canyonlands National Park) and a front-country setting (Mount Rushmore National Memorial).

Another objective of the study—specifically in Canyonlands National Park—was to determine whether river users who demonstrated differing levels of agreement concerning place attachment on the Green and Colorado Rivers responded differently to questions about trip motives and potential management actions. An affinity for different motives and management actions could demonstrate a need for management plans that address differing recreational needs of users on these two rivers.

Two types of place attachment were measured: emotional/symbolic and functional. Emotional/symbolic attachment, also referred to as place identity (Stokols and Shumaker 1981, Schreyer and others 1981), refers to the emotional or symbolic ties an individual may feel for a specific place. Personal emotional ties to a frequently visited park could represent this type of place attachment. Emotional/symbolic attachment also may be expressed as an identity with a symbolic meaning or idea. For example, an individual may identify with the idea of heritage, as symbolized by the National Park System, or the idea of wilderness.

Functional attachment, also referred to as place dependence (Stokels and Shumaker 1981; Schreyer and others 1981), describes the use of a resource to satisfy a need or goal. In a recreational setting, functional attachment often is related to the activity an individual may pursue in the context of the resource. Some activities are passive, such as viewing scenery, whereas others, such as whitewater rafting, involve close physical contact with the resource. The constructs of emotional/symbolic attachment and functional attachment have been presented in other recreational studies in the past ten years (Moore and Graefe 1994; Mitchell and others 1993; Williams and others 1992).

Study Areas

Canyonlands National Park, a backcountry setting, is in southeastern Utah. The Park encompasses 527 square miles and provides opportunities for numerous recreational activities, including hiking, camping, backpacking, mountain biking, four-wheeling and river running. Within park boundaries, the Green and Colorado Rivers offer river runners opportunities for several types of river experiences. Above the confluence, the calm waters of the Green and Colorado Rivers present favorable conditions for flatwater river trips. Several miles below the confluence of the two rivers, the Colorado River flows through Cataract Canyon, offering river runners approximately 14 miles of whitewater and 28 rapids (with difficulty ratings of up to class 5). The Green River is popular with canoers and kayakers and receives less motorized traffic than the Colorado River. Conversely, the Colorado River receives more commercial use (guided trips) than the Green River. Managers at Canyonlands are currently in the process of developing an updated river management plan for the Green and Colorado Rivers. The place attachment study was conducted as part of a larger visitor use study to gather a variety of data about river users (Warzecha and others 1999).

Mount Rushmore National Memorial, a front-country setting, is in southwestern South Dakota. The Memorial is considered a tribute to the birth, growth, preservation and development of the United States. The primary resource is

In: Cole, David N.; McCool, Stephen F.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 4: Wilderness visitors, experiences, and visitor management; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-4. Ogden, UT: U.S.

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the granite sculpture of Presidents Washington, Jefferson, Roosevelt and Lincoln. In 1998, the Memorial celebrated the completion of a 10-year redevelopment project that includes a new visitor center and museum, amphitheater, parking garage and Presidential Trail. This place attachment study was done as part of a larger study to determine visitor response to the new visitor facilities (Thompson and Lime 1999).

Methods for Study Site Comparisons

At Canyonlands National Park, data were collected through the use of a trip diary and a post-trip questionnaire. Both were distributed to parties before the beginning of their river trip. Sampling occurred from late May through mid-October 1998. On the Green River, a total of 173 diaries and post-trip surveys were distributed to river users, garnering an 83 percent response rate. A total of 567 surveys were distributed to river users on the Colorado River, for a response rate of 69 percent. Respondents either gave their diaries and questionnaires to their outfitter at the completion of their trip or returned them using the self-addressed stamped envelope provided.

At Mount Rushmore National Memorial, data were collected through the use of an on-site questionnaire. Sampling occurred from June through August 1998. A total of 973 questionnaires were completed. Less than 10 percent of visitors contacted declined to participate in the visitor use study.

To measure emotional/symbolic and functional place attachment, our study used place attachment statements from previous research by Williams and others (1995). Visitors were asked to respond to a set of 12 statements measuring place attachment. Six statements measured emotional/symbolic attachment:

I would prefer to spend more time here if I could.
I am very attached to this place.
I identify strongly with this place.
I feel like this place is part of me.
This place means a lot to me.
This place is very special to me.

Six statements measured functional attachment:

No other place can compare to this area.
The time I spent here could have just as easily been spent somewhere else.
I get more satisfaction out of visiting this place than from visiting any other.
This area is the best place for what I like to do.
This place makes me feel like no other place can.
I can't imagine a better place for what I like to do.

Respondents were asked to rate each statement on a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree). For each study site (Green River, Colorado River and Mount Rushmore), grand mean scores were calculated for emotional/symbolic attachment and functional attachment to determine the strength of respondents' agreement with the place attachment statements. (For analytical purposes, the five-point scale was reversed for the statement "The time I spent here could have just as easily been spent somewhere else" so it could be compared to the other functional statements.)

We used SPSS/PC+ to run two-tailed t-tests to determine whether there were statistically significant differences between study sites. Using Cronbach's Alpha, we examined the inter-item reliability for the six statements measuring emotional/symbolic attachment and the six statements measuring functional attachment.

Results of Study Site Comparisons

Levels of emotional/symbolic attachment were compared for the Green and Colorado Rivers in Canyonlands National Park and Mount Rushmore National Memorial (table 1). Statistically significant differences in levels of agreement with emotional/symbolic place attachment statements were evident among the sample of respondents at all study sites. Mean scores were highest for the Green River (3.98) and lowest for Mount Rushmore (3.54). Inter-item reliability for the six statements, as reflected by the Alpha scores, ranged from 0.88 to 0.91.

Levels of functional attachment were compared across three study sites (table 2). Statistically significant differences in levels of agreement with functional place attachment statements were demonstrated between the Green and Colorado Rivers as well as between the Green River and Mount Rushmore. Mean scores were highest for the Green River (3.59) and lowest for Mount Rushmore (3.32). Overall, the inter-item reliability coefficients for functional attachment statements were nearly as high as the emotional/symbolic statements (0.82 to 0.88).

Table 1—Levels of emotional/symbolic place attachment for three study sites.

Study area	N	Mean*	SD	Alpha
Green River	137	3.98[ab]	0.78	0.91
Colorado River	376	3.80 [ac]	.73	.88
Mount Rushmore	832	3.54[bc]	.69	.88

*Means identified with the same letter are significant at the $p < 0.05$ level.

Table 2—Levels of functional place attachment for three study sites.

Study area	N	Mean*	SD	Alpha
Green River	136	3.59[ab]	0.85	0.88
Colorado River	374	3.33[a]	.78	.87
Mount Rushmore	834	3.32[b]	.67	.82

*Means identified with the same letter are significant at the $p < 0.05$ level.

Methods for Green and Colorado River Comparisons

In addition to determining levels of emotional/symbolic attachment and functional attachment at these study sites, we investigated differences in place attachment between river users. As an exploratory research effort, we sought to determine whether there was a relationship between high and low levels of agreement with place attachment statements and respondents' motives for taking a river trip as well as support for potential management actions in the Park.

Using a five-point Likert scale, respondents were asked to rate the importance of 23 different motives for taking a river trip (1 = not at all important, 2 = slightly important, 3 = moderately important, 4 = very important and 5 = extremely important). Respondents also were asked to rate their support for 23 potential management actions using a four-point Likert scale (1 = strongly oppose, 2 = oppose, 3 = support, and 4 = strongly support).

As part of the exploratory analysis, we looked at the mean scores in the highest and lowest quintile for emotional/symbolic attachment and functional attachment for both the Green and Colorado Rivers. Thus, the highest and lowest 20 percent of the mean scores for each type of place attachment for each river were categorized as having either a "high" or "low" level of agreement with the place attachment statements as compared to scores in the remainder of the sample. Utilizing quintiles allowed us to examine both ends of the agreement spectrum while maintaining a sufficient sample size. Although the upper and lower quintiles do not represent the majority, it is important to recognize that these groups may serve as an important barometer in evaluating attitudes about resource management issues.

We used SPSS/PC+ to run two-tailed t-tests to determine whether there were statistically significant differences between respondents with high and low levels of agreement with emotional/symbolic and functional attachment statements and how they responded to statements regarding motives for taking a river trip as well as potential management actions. We examined differences in responses *within* the Green River and *within* the Colorado River as well as *between* the Green and Colorado Rivers for respondents demonstrating high and low levels of agreement with the place attachment statements

Results of Green and Colorado River Comparisons

For both types of place attachment, respondents with high and low levels of agreement indicated differences in the importance of motives for taking a river trip (rated on a five-point scale). These differences were apparent both within the Green and Colorado Rivers and between the Green and Colorado Rivers. For both rivers, the importance of experiencing solitude, for example, was rated higher for respondents with high levels of agreement with emotional/symbolic statements than for respondents with low levels of agreement (table 3). In addition, experiencing solitude was more important for Green River respondents with high levels of emotional/symbolic agreement (4.75) than for respondents on the Colorado River with high levels of agreement (4.03). For functional attachment, significant differences were found between respondents with high and low levels of agreement on the Green River (4.72 and 3.79, respectively). Statistically significant differences also existed between respondents with high levels of agreement on the Green and Colorado Rivers (4.72 and 3.87, respectively).

Strength of agreement also was associated with statistically significant differences in respondents' ratings of the importance of experiencing an undeveloped river (table 4). For the Green and Colorado Rivers, respondents with high emotional/symbolic agreement rated the importance of experiencing an undeveloped river higher than respondents with low agreement. Experiencing an undeveloped river was rated more important by Green River users expressing high emotional/symbolic agreement (4.82) than by Colorado River users expressing high agreement (4.43). The same pattern emerged for respondents with low levels of agreement. Evaluation of functional attachment, as associated with the importance of experiencing an undeveloped river, revealed significant differences between respondents with high and low levels of agreement on the Green River (4.84 and 4.38, respectively). Statistically significant differences also existed between respondents with high and low levels of agreement on the Green and Colorado Rivers.

Respondents' support for potential management actions (rated on a four-point scale) also were associated with their levels of agreement with place attachment statements. Regarding emotional/symbolic attachment, respondents on the Green River with high levels of agreement (table 5) exhibited more support for prohibiting motorized rafts than respondents with low levels of agreement. For both emotional/symbolic and functional attachment, significant differences also were found between rivers at both levels of agreement.

Table 3—Importance of solitude for respondents with high and low place attachment on the Green and Colorado Rivers in Canyonlands National Park.

	Emotional/symbolic attachment		Functional attachment	
	Colorado River	Green River	Colorado River	Green River
Low	3.36[a]	3.83[a]	3.62	3.79[a]
High	4.03[ab]	4.75[ab]	3.87[b]	4.72[ab]

Means identified with the same letter are significant at the p <0.05 level.

Table 4—Importance of experiencing an undeveloped river for respondents with high and low place attachment on the Green and Colorado Rivers in Canyonlands National Park.

	Emotional/symbolic attachment		Functional attachment	
	Colorado River	Green River	Colorado River	Green River
Low	3.88[ab]	4.33[ab]	3.90[b]	4.38[ab]
High	4.43[ab]	4.82[ab]	4.19[b]	4.84[ab]

Means identified with the same letter are significant at the p <0.05 level.

Table 5—Support for prohibiting motorized rafts for respondents with high and low place attachment on the Green and Colorado Rivers in Canyonlands National Park.

	Emotional/symbolic attachment		Functional attachment	
	Colorado River	Green River	Colorado River	Green River
Low	1.65[b]	2.55[ab]	1.78[b]	2.77[b]
High	1.88[b]	3.47[ab]	1.89[b]	3.41[b]

Means identified with the same letter are significant at the p <0.05 level.

Table 6—Support for reserving campsites and maintaining a predetermined itinerary for respondents with high and low place attachment on the Green and Colorado Rivers in Canyonlands National Park.

	Emotional/symbolic attachment		Functional attachment	
	Colorado River	Green River	Colorado River	Green River
Low	2.66[ab]	1.48[b]	2.57[b]	1.48[b]
High	2.24[ab]	1.55[b]	2.39[b]	1.41[b]

Means identified with the same letter are significant at the p <0.05 level.

Significant differences in ratings of support for reserving campsites and maintaining a predetermined itinerary were found between the two rivers for both emotional/symbolic and functional attachment (table 6). In comparison to respondents on the Colorado River, respondents on the Green River indicated lower levels of support for this type of management action. On the Colorado River, respondents with high levels of agreement with emotional/symbolic statements indicated less support for reserving campsites and maintaining a predetermined itinerary (2.24) than respondents expressing low levels of agreement (2.66).

Discussion

Using 12 place attachment statements, we were able to measure the level of agreement and identify distinct relationships for both emotional/symbolic and functional place attachment at three different recreational settings at the two National Park Service units. As such, this analysis provides another useful variable for segmenting visitors with respect to their preferences and attitudes concerning recreation settings. A sound understanding of visitor preferences and attitudes is critical in the development of a successful management plan. As suggested by Moore and Graefe (1994), managers need to recognize the importance of place attachment and incorporate it into the planning process.

Based on respondents' level of agreement concerning their emotional/symbolic and functional attachment to the resource, users on the Green and Colorado Rivers assigned different levels of importance to their motives for taking a river trip. In addition, respondents indicated different levels of acceptance for potential management actions, depending on the strength of their attachment to the resource. Statistically significant differences were found both *within* the Green and Colorado Rivers as well as *between* the two rivers. Compared to river users with a high level of agreement concerning place attachment on the Colorado, Green River users with a high level of agreement indicated a stronger desire for wildland experiences and management actions that provide opportunities for those types of experiences.

Based on the findings, we think it is appropriate for National Park Service planners and managers to consider different management strategies for these two river resources in Canyonlands National Park. Each river has the potential for different recreational opportunities, thus attracting people seeking different kinds of experiences. The results of this study lend support for the establishment of management guidelines that would best fulfill differing visitor needs. Implementation of Recreation Opportunity Spectrum (ROS) could provide a nonmotorized, low-density use setting on the Green River, allowing visitors an increased feeling of solitude in a minimally developed setting. On the Colorado River, current conditions provide opportunities for private and commercial user groups and a variety of watercraft.

Failure to consider different management scenarios for the Green and Colorado Rivers could lead to the displacement of Green River visitors. As stated by Mitchell and others (1993), "what is lost may perhaps never be replaced or substituted." Arguably, wildland settings are becoming less abundant, and people seeking backcountry, solitude-oriented experiences may be more easily displaced than other user groups. Sustaining a broad spectrum of opportunities for visitors would allow Canyonlands National Park to better meet the needs of a greater diversity of user groups.

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3. Information and Education

Wilderness on the Internet: Identifying Wilderness Information Domains

Chuck Burgess

Abstract—Data collected from an online needs assessment revealed that Web site visitors with an interest in wilderness seek several different types of information. In order to gain further insight into the process of Web use for wilderness information, a follow-up analysis was conducted. This analysis was exploratory in nature, with the goal of identifying information domains of interest to potential audiences and to determine why certain groups of individuals have different information needs. The data were factor analyzed to determine logical information domains. Six information domains were revealed that could be used as a guide for creating structure for a Web site containing wilderness information. Subsequent analysis to determine factors that contribute to cluster membership was inconclusive.

The Internet and specifically the World Wide Web, or the Web as it is commonly known, have grown dramatically since their inception in the early 1990's. One study showed that in 1997, 43 percent of Americans lived in a household with one or more working computers, and 16 percent had access to the Internet in their home (National Science Board 1998). The number of people with access is predicted to triple by the year 2002 (Jupiter Communications 1996).

The wilderness community understood the great potential of the Internet as a medium for wilderness information exchange. In 1996, a task force of federal agency representatives including staff from the Arthur Carhart National Wilderness Training Center, the Aldo Leopold Wilderness Research Institute and faculty and staff from the University of Montana, convened to address the need for a comprehensive online wilderness information resource. The proposed target audience for this resource included wilderness managers, educators, researchers, advocates and the general public. Driving the need was a lack of online resources for the "Wilderness Management by Distance Education" courses that the University of Montana recently started offering. In addition, it was noted that wilderness information found online was often inaccurate. A unified effort to correct these problems could develop an information resource of great value.

The task force identified a number of initial steps to be taken before the new Web site could become operational. Among these was a needs assessment to identify potential audiences for wilderness information and determine their information needs. Without a clear picture of the potential audience for this new Web site, it was necessary to brainstorm a long list of information categories, in the hope that most respondents would find at least one area of interest. The medium chosen for the needs assessment was an online Web-based survey.

Methods

The survey was conducted online through the Wilderness.Net (http://www.wilderness.net) Web site from January to November 1997. The goal of the needs assessment was to determine information needs, characteristics of current Web users and their perceptions of the Web. Useable responses were collected 184 from wilderness managers, students, researchers and the general public.

Although utilizing a Web-based format for survey has several drawbacks—for example, it is very difficult to obtain a random sample, and there are no assurances that Web site visitors who submit the survey will do so only once—it was chosen not only to collect data about information needs, but to explore the potential of the Web. In addition, it was determined that this method would allow a much broader audience to provide feedback about the development of this resource, an important first step in building an online wilderness community. Alternative needs assessment methods, such as mail-back and phone surveys, were not pursued due to the lack of financial resources necessary to collect the data.

Potential types of wilderness information were collected through interviews with wilderness educators, researchers and land managers. Thirty-five (table 1) wilderness information topics (such as fire, recreation management, etc.) were presented to respondents. Each respondent was asked to rate these information topics in terms of their perceived benefit if made available online. Coding involved assigning a number based on the respondent's benefit level shown for each item. The respondent could choose from three benefit levels ranging from "Very Beneficial" (1) to "No Benefit" (3). As anyone could complete the survey on the Web site, it should be considered a convenience sample. Respondents who listed their age as less than 18 were not considered in this study, in keeping with the guidelines set by the University of Montana's Human Subjects review board.

Results

Of the 184 useable responses to the online survey, 24 percent were female and 76 percent male. Respondents ranged in age from 19 to 65 years old, with a mean of 38. The

In: Cole, David N.; McCool, Stephen F.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 4: Wilderness visitors, experiences, and visitor management; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-4. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

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Table 1—Information needs included in online survey.

Recreation behavior research	Bulletin Board to post notices
Social conflict research	Management issues and potential solutions
Recreation use trends	Maps of wilderness areas
Solitude/crowding research	Rules and regulations for specific wilderness areas
Recreation impacts/ecology research	Current conditions (i.e. weather, fire, trail etc.) for specific wilderness areas
Agency management plans	Leave No Trace program information
Positions of major environmental groups	Ecological research
Discussion area for various wilderness issues	Wilderness ecology issues
Wilderness management training materials	Monitoring issues/procedures
Wilderness education college courses by correspondence	Interactive databases
Wilderness curriculum guide for all grade levels	Geographic Information Systems of specific wilderness areas
Wilderness curriculum from various universities (degree programs, syllabi)	Wilderness/nature writing
Wilderness management training materials	Wilderness history
Site restoration techniques	Wilderness philosophy
Current events in wilderness	Fire management issues
Wilderness Study Area issues	Wilderness management policies of agencies and tribes
Wilderness related legislation	Economic impact research
International wilderness areas, systems and issues	

largest percentage of respondents identified themselves as affiliated with educational institutions as either teachers or students (36%). The second highest employment category was federal agency personnel (30%). Of the agency personnel, the U.S. Forest Service contributed the most, with 51%. The U.S. Fish and Wildlife Service contributed 8% (figure 1). The additional 44% of respondents identified themselves in employment categories not easily grouped.

In the second step, a factor analysis of the responses to the 35 wilderness information topics was conducted. Factor analysis was first introduced by Thurstone (1931) and is conducted to reduce the number of variables and to detect structure in the relationships between them. Factor analysis is primarily applied as a data reduction tool. In the present study, it was applied to find domains of wilderness information from the list of 35 presented to respondents.

Determining the correct number of factors to include in an analysis is a matter of judgment. However, there are some guidelines commonly used. The criterion proposed by Kaiser (1960) states that only factors with eigenvalues greater than one should be retained. Using this criterion, nine factors (principal components) would be retained. A graphical method is the *scree* test first proposed by Cattell (1966), who suggested identifying the inflection point in the line where eigenvalues appear to level off to the right of the plot. According to this criterion, four factors would be retained.

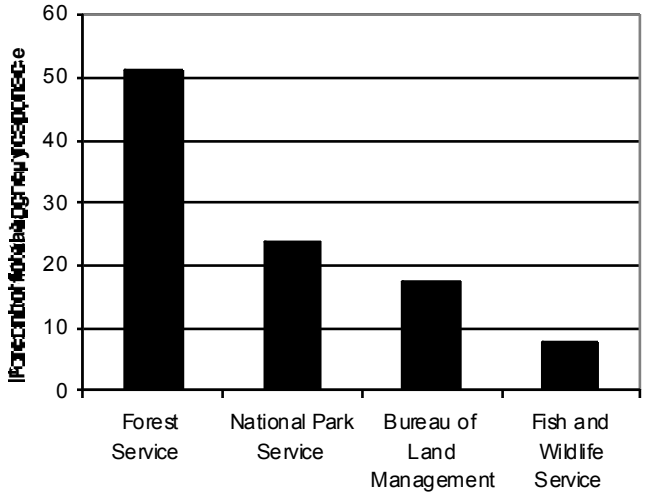

Figure 1—Federal agency affiliation of respondents.

Using the Kaiser criterion and the scree tests to frame the limits on the number of factors provided an upper limit of nine factors and a lower limit of four. In order to finalize the number of factors, the next step was to determine a set of factors that were interpretable. A four-factor solution did not provide enough categories to demonstrate the variability in information types, and nine factors provided too much detail that was not useful. After examining variable placements with several different factor numbers, six were chosen as the appropriate number of factors that placed variables of similar type together.

The next step in the analysis was to construct factor scales. Scales containing each of the variables were analyzed by extracting variables until the maximum Cronbach's Alpha was achieved. The resulting list of variables was decreased from the original 35 to 26. The total variability explained by the factor solution is 54.98%.

Factor names resulted from the characteristics of the variables within each factor. Each new factor scale resulted from totaling the values from all of the variables making up that factor and dividing this total by the number of variables. The variables making up factor one dealt with human impacts and use levels in wilderness and was called "Impacts/Social." Factor two variables included training, curriculum and other aspects of education and was named, "Education/Training." Factor three variables consisted of current events in wilderness, wilderness legislation, and management issues and potential solutions, etc. This factor was named, "General." Factor four variables consisted of information about specific wilderness areas including rules and regulations, maps and current conditions. This factor was named, "Specific." Factor five involved ecological research, wilderness ecology issues and monitoring

issues/procedures and was named "Ecological." Factor six variables were associated with higher education, history, philosophy and writing. This factor was named, "Academic." Table 2 shows the factor scales and the Cronbach's Alpha for each scale.

The next step in the analysis requires a clustering of the respondents into homogenous groups based on the information factor scales. Cluster analysis (first used by Tryon 1939) is a technique used to organize observed data into meaningful structures. In this study, it was utilized as a means to classify individual respondents into groups based on their information needs.

After deciding on the appropriate number of clusters (three), each case was identified by its cluster membership. Table 3 shows the mean scores of each cluster for each factor. The clusters were named based on the domains to which they assigned high importance. Cluster one placed high importance on the visitor and general information domains and was named "Visitor-Oriented." Cluster two placed high importance on the management and impacts/social domain and was named "Resource Oriented." Cluster three placed relatively high importance on all of the benefit factors and was thus named "Information Enthusiasts."

The next step in the analysis was to determine factors that contribute to cluster membership. Three types of variables were examined, including sociodemographic variables about respondents, mass-media resources used by respondents and respondent attitudes about the Web (quality, speed, efficiency, etc.). Several independent variables were cross-tabulated with the new variable, "cluster membership," but

Table 2—The information items making up each factor and Cronbach's reliability coefficients for the factor scale.

Factor Name	Item	Scale Reliability
Impacts/Social	Social conflict research	.8137
	Solitude/crowding research	
	Recreation behavior research	
	Recreation use trends	
	Recreation impacts/ecology research	
	Wilderness management policies of agencies and tribes	
Education/Training	Wilderness management training materials	.7538
	Wilderness education college courses by correspondence	
	Wilderness curriculum guide for all grade levels	
	Wilderness curriculum from various universities	
	Wilderness training calendar	
General	Wilderness Study Area issues	.7028
	Current events in wilderness	
	Wilderness legislation	
	International wilderness areas, systems and issues	
	Bulletin Board to post notices	
	Management issues and potential solutions	
Specific	Current conditions (i.e. weather, fire, trail etc.) for specific areas	.7206
	Rules and regulations for specific wilderness areas	
	Maps of wilderness areas	
Ecological	Ecological research	.6036
	Wilderness ecology issues	
	Monitoring issues/procedures	
Academic	Wilderness/nature writing	.6938
	Wilderness history	
	Wilderness philosophy	

Table 3—Mean cluster scores for each information domain (factor).

	Factors					
	Ecological	Impacts/Social	Education/Training	General	Specific	Academic
Clusters						
Visitor-Oriented	2.03	2.00	1.97	2.11	2.76	1.93
Resource-Oriented	2.40	2.31	1.86	2.16	1.55	1.68
Information Enthusiasts	2.67	2.69	2.44	2.59	2.45	2.51

Table 4—Respondents who read professional journals by cluster.*

		Cluster			
		Visitor Oriented	Resource Oriented	Information Enthusiasts	Total
No	Count	18	5	13	36
	% within Cluster	35.3%	11.6%	14.4%	19.6%
Yes	Count	33	38	77	148
	% within Cluster	64.7%	88.4%	85.6%	80.4%
Total	Count	51	43	90	184
	% within Cluster	100.0%	100.0%	100.0%	100.0%

*Pearson Chi-Square = .004.

Table 5—Respondents who read recreation-oriented magazines by cluster.*

		Cluster			
		Visitor Oriented	Resource Oriented	Information Enthusiasts	Total
No	Count	2	8	9	19
	% within Cluster	3.9%	18.6%	10.0%	10.3%
Yes	Count	49	35	81	165
	% within Cluster	96.1%	81.4%	90.0%	89.7%
Total	Count	5143	90	184	
	% within Cluster	100.0%	100.0%	100.0%	100.0%

*Pearson Chi-Square = .065.

none of the subsequent analyses uncovered interpretable results that would help explain cluster membership.

Variables measuring sociodemographic examined included gender, age and employment category. None of these analyses uncovered statistically significant results.

Both professional journal (table 4) and recreation-oriented magazine readership (table 5) demonstrated statistically significant relationships when cross-tabulated with cluster membership. As would be expected, both the resource-oriented and information enthusiasts clusters reported that they have read professional journals in the past year, and both the visitor-oriented and information enthusiasts clusters reported reading recreation-oriented magazines in the past year. The statistically significant results shown in these two tables should be interpreted with caution because of the instances where cells contain five or fewer cases.

Several variables measuring respondent Web use and attitudes toward the Web were cross-tabulated with cluster membership. Two statistically significant relationships were uncovered through this analysis: attitudes about the quality of information found on the Web (table 6) and preferences about digital information versus other types of information (table 7). In both of these examples, the relationship between attitude and cluster membership is unclear and is further clouded by high counts in the "Neutral" category.

Table 6—Respondents who believe the information found on the web is of greater quality than other information sources by cluster.*

		Cluster			
		Visitor Oriented	Resource Oriented	Information Enthusiasts	Total
Disagree	Count	12	22	27	61
	% within Cluster	25.5%	55.0%	32.9%	36.1%
Neutral	Count	25	12	33	70
	% within Cluster	53.2%	30.0%	40.2%	41.4%
Agree	Count	10	6	22	38
	% within Cluster	21.3%	15.0%	26.8%	22.5%
Total	Count	47	40	82	169
	% within Cluster	100.0%	100.0%	100.0%	100.0%

*Pearson Chi-Square = .037.

Table 7—Respondents reporting a preference for digital information by cluster.* **

		Cluster			
		Visitor Oriented	Resource Oriented	Information Enthusiasts	Total
Disagree	Count	7	12	22	41
	% within Cluster	14.3%	28.6%	24.7%	22.8%
Neutral	Count	18	15	41	74
	% within Cluster	36.7%	35.7%	46.1%	41.1%
Agree	Count	18	12	13	43
	% within Cluster	36.7%	28.6%	14.6%	23.9%
Strongly Agree	Count	6	313	22	
	% within Cluster	12.2%	7.1%	14.6%	12.2%
Total	Count	49	42	89	180
	% within Cluster	100.0%	100.0%	100.0%	100.0%

*In response to the statement, "I prefer my information in digital form rather than paper format."

**Pearson Chi-Square = .070.

Discussion

The study was conducted with two goals in mind: 1) to determine if there were logical domains of wilderness information whose use was correlated with each other, and 2) to determine what factors contributed to respondent information needs. The following section will address the extent to which the study contributed to a further understanding of the study goals.

These results of this study are very useful in terms of the continued development of the Wilderness.Net site, as it revealed six distinct information domains, or groupings of information types that can be used as a guide for creating structure for the site. Specifically, the identified information domains can be used as organizational categories for navigation. Hopefully, utilizing empirically derived relationships will enable visitors to the Web site to locate information faster and easier. This in turn could produce more repeat visitation and enhance the information-retrieval process.

Subsequent analysis to determine factors that contribute to cluster membership was inconclusive. Relationships were examined between self-reported sociodemographic information and attitudes toward the Web. Analysis revealed four independent variables that were associated with cluster membership, but these results did not offer any meaningful conclusions. The results of the analysis demonstrated that mass-media readership plays a role in predicting the type of information sought, but no other demographic data were correlated. These findings, however, do not offer enough evidence to draw any conclusions about cluster membership.

One conclusion that could be drawn from these results is that the act of seeking wilderness information on the Web is not related to specific demographic data about an individual. Regardless of age, gender, or income, etc. respondents were equally attracted to various information topics about wilderness.

The final list of wilderness information included 26 different types after conducting the factor analysis. Because the list of wilderness information types was so broad, there may have been temporal factors that would decrease the ability of clustering to properly segment the individuals into usable clusters. By relying on a broad list of wilderness information to categorize persons in an overall way, we may have inadvertently missed the fact that people have different information needs at different times. For example, scientists may need ecological research as part of their job, and they may need both rules and regulations and maps for a specific wilderness area for a planned backpacking trip. The present study did not measure this important variable, information use. The temporal distinctions mentioned above point to the need for further investigation about the intended use of the specific wilderness information.

The present study identified several wilderness information domains that should be verified through a follow-up survey to test their reliability. Future attempts to segment individuals in terms of their wilderness information needs should rely upon a univariate measure that allows respondents to choose a category from a list (research-oriented, management-oriented, education-oriented, etc.). In order to overcome the temporal problems in the present study, future research should ask respondents to rate their information needs based on its intended use. For example, when respondents first view the survey instrument, they could be asked to identify themselves by one of the following roles: student, scientist, teacher, land manager, backpacker, environmental activist, etc. They would then be instructed to rate the information types in terms of their benefit to the role they just selected and to that role only. This method of respondent categorization would probably increase the likelihood of determining factors that contribute to individual information needs.

Wilderness information on the Internet will continue to play an important role into the future as more and more people go online and the global demand for information increases. The results of this study demonstrate that the following wilderness topics are important to many audiences: impacts/social, education/training, general, specific, ecological and academic. These information topics appear to

be useful to all audiences regardless of gender, age, occupation or mass-media reliance. Furthermore, it appears as though most individuals are not solely interested in one aspect of wilderness; rather, they seek several different types. It is important to note that the sample this study is based on is limited and probably has a higher than average interest in wilderness. Nevertheless, the implications of this are far reaching. If an informed constituency, or even the potential for an informed constituency, can make it easier for policy-makers and advocates to accomplish their goals, then the value of resources like Wilderness.Net is tremendous.

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Magazines as Wilderness Information Sources: Assessing Users' General Wilderness Knowledge and Specific Leave No Trace Knowledge

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Abstract—The *Leave No Trace* (LNT) educational program has the potential to provide wilderness users with useful minimum impact information. For LNT to be effective, managers need to understand who is most/least aware of minimum impact practices and how to expose users to LNT messages. This study examined LNT knowledge among various user groups at an Eastern wilderness area and assessed which types of magazines they read on a regular basis. Findings indicate that readers of outdoor recreation (consumptive) and equine sports magazines had lower LNT scores than did readers of outdoor recreation (nonconsumptive) and environmental magazines. The implications of placing LNT messages in "offsite" publications are examined.

Social and ecological impacts continue to be a major concern among wildland resource managers (Hammitt and Cole 1987; Hendee and others 1990). Such impacts have been associated with ecological degradation in many pristine areas (Hammitt and Cole 1987). Altering use patterns and/or changing user behavior are major goals for the many management activities designed to minimize these undesirable impacts (Manfredo 1992). Existing wilderness management literature such as Roggenbuck (1992) encourages the use of indirect strategies (such as education) to change user behaviors over the use of direct management strategies (such as regulation and/or enforcement).

Although there have been many informal educational initiatives over the years, only recently have concerted efforts focused on an accepted set of accepted minimum impact practices. These efforts have produced formalized educational programs emphasizing minimum impact practices. One of these programs, LNT, seems poised to become a viable program to disseminate practical user information about appropriate backcountry camping and activity behaviors (Monz and others 1994). According to Barnes and Krumpe (1995), formal educational campaigns and programs such as LNT have gained popularity among managers and the general public. For example, in 1995, LNT was ranked 6th in terms of important wilderness management topics up ten spots from its 1983 rank of 16th.

The mission of the LNT program is to promote and inspire responsible outdoor recreation through education, research and partnership. It involves the cooperation of many state and federal natural resource agencies, as well as nonprofit environmental organizations and corporate partners. The program is designed to disseminate accepted minimum impact practices at the grassroots level and to encourage common sense, context-specific decision-making rather than dogmatic adherence to rigid standards. The revised LNT principles as cited by the National Outdoor Leadership School (1999) instruct recreationists to:

1. Plan ahead and prepare.
2. Travel and camp on durable surfaces.
3. Dispose of waste properly.
4. Leave what you find.
5. Minimize campfire impacts.
6. Respect wildlife.
7. Be considerate of other visitors.

Research on user knowledge of minimum impact practices and subsequent behavioral change is sparse but growing. For example, Cole and others (1997) examined how effectively trailside bulletin boards influence knowledge of low-impact practices. While these authors did not specifically focus on LNT practices, they did find that exposure to suggestions for minimum impact behaviors (similar to LNT practices) led to increased low-impact knowledge. However, these authors discovered that not all user groups gave the onsite messages equal attention. They found that although 71% of hikers stopped and looked at the messages, only 27% of horse users stopped. Moreover, hikers attended to messages for a longer time period than horse users (22 seconds vs. 14 seconds). A subsequent study by Cole (1998) involved the placement of written appeals for attention to the minimum impact messages. These written appeals appeared to affect the length of attention given to the minimum impact messages; average attention time was higher than that for messages without written appeals and for the previous trail bulletin study (Cole 1998).

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These findings are consistent with the review conducted by Vander Stoep and Roggenbuck (1995) who indicated that the effectiveness of different sources, messages, channels can vary widely across diverse user groups. Hence, there is a need to understand the specific user group that the message is targeted to and apply the appropriate educational intervention. The general consensus is that, in terms of source and channel, onsite personal contacts tend to be the most effective at influencing subsequent behavior (Vander Stoep and Roggenbuck 1995).

However, there may still be justification for communicating minimum impact practices in offsite, non-personal settings. For example, Cole (1998) said that because a large number of users will not interrupt their recreation activity to read trailside messages, other means of communication are needed. These other communication tools can include offsite communications such as special events, outreach programs and media spots (radio, television, print) used in concert with onsite methods such as signage, brochures and ranger contacts. Vander Stoep & Roggenbuck (1995) indicated that providing educational messages to recreationists before they actually visit a setting allows the visitor adequate planning time to implement the desired behavior. Vander Stoep & Roggenbuck (1995) also suggest that outreach communications can serve as a reminder to reinforce onsite educational messages and to enhance long-term awareness and adoption of behaviors.

There are several tiers to educational programming ranging from the site-specific level (where the resource manager has the most direct control to cater the message to specific user groups) to the national level (where agency and organization administrators determine policies and basic educational principles). Often, communicators are concerned not only with how well a message is received by a target group, but also by how many people are exposed to and attend to a message. Each level of communication may involve also messages with slightly different educational goals (i.e., awareness of an educational program, awareness of appropriate actions at a specific wilderness) and varying sources which best serve to deliver the message. Assael (1995) has indicated that prior exposure to a message can stimulate subsequent message recognition and comprehension when faced with a repeat exposure to the message. The implication here is that, if offsite communications places the LNT in a visitor's memory, their attention and comprehension of the message can then be reactivated when they see the message onsite.

The *Leave No Trace* organization has suggested that, to become a truly national educational program, communications must branch out beyond the use of pamphlets, brochures, onsite signage and training curricula. There is a great need for print media attention, outdoor product manufacturer involvement, and televised media attention (National Outdoor Leadership School, 1999). Simmons Market Research, a nationwide secondary data source, has also indicated that 75 - 86% of all outdoor recreationists read popular magazines (Simmons Market Research Bureau, 1994). As such, magazines can also serve as a viable platform to communicate basic information about the LNT program. Both national and regional magazines can serve to support the more in-depth onsite information being disseminated at trail heads and during personal onsite agency-visitor contacts.

However, accessing adequate magazine space can be an expensive proposition for agencies and organizations who wish to disseminate the LNT message to a broader audience. Leaders of the LNT and other wilderness education program will have to place these messages in magazines where they will make the most impact (i.e., communicate the message to those who have not heard about it or who are less aware about specific components of the program). As such, it would be helpful to understand who has a lower level of LNT knowledge and what kinds of magazines do they read. Answers to this question will help guide administrators at the nationwide level to select types of magazines for communicating LNT.

This paper seeks to expand upon the state-of-knowledge developed through the efforts of Cole and others by examining: (1) LNT knowledge among various constituents or user groups, (2) where those groups get their information about wilderness, and (3) what kinds of types of magazines these groups are likely to read. User groups with lower LNT knowledge who do not respond to onsite communications or who never get exposed to them may be reached through offsite messages placed in popular magazines if their magazine choices were known. Findings of this study should assist LNT partners and administrators as they target their messages to specific recreation audiences in specific, nontraditional message outlets. A wider constituency could then be exposed to and made aware of the program and its messages.

Methods

This study used a combination of onsite and mail surveys. The overall study area was the Hickory Creek Wilderness and Hearts Content Recreation Area in the Allegheny National Forest, located in northwestern Pennsylvania. The Hickory Creek Wilderness is one of only two congressionally designated units of the National Wilderness Preservation System (NWPS) in Pennsylvania, Ohio, New York, New Jersey and Maryland. This Wilderness encompasses 8,663 acres and contains one designated trail. Its proximity to Cleveland and Pittsburgh urban areas combined with its proximity to other front country developed recreation opportunities make it a conveniently situated urban-proximate wilderness area. Managers at this area have been observing increased site impacts as a result of improper use of facilities and resources. However, since its inclusion in the NWPS, there have been few public education or information programs developed or implemented at this site. As a result, a study was undertaken to understand and refine the effectiveness of USDA Forest Service communications and to provide generalized guidance for the development of a site-specific education plan to reduce negative visitor impacts.

While the goal of the overall study was to identify gaps in visitor knowledge, the specific objective of this research was to: (1) examine whether defined user groups had different levels of LNT knowledge and, if they did, (2) understand what kinds of magazines various user groups were most likely to read. If managers knew that certain user groups had low awareness or knowledge levels and if they knew which mass communication outlets this group utilized, they may be able to more efficiently communicate the LNT program to users who are less aware of LNT practices or who are hard to reach with an onsite communication effort.

Mass communication outlets such as magazines are an important channel to integrate into the LNT communication effort because they can also serve as a starting point to help make users aware of a national educational campaign. In other words, they can be used as a platform to help the user become aware of LNT, its logo, and its basic purpose. Follow-up messages onsite and in regional resources may then be used to build upon this basic message with more site-specific information. The LNT program is aware of this role and has several partnerships established with several of the more popular outdoor magazines. The question is whether these partner magazines draw readership from people who are already knowledgeable about the program and its message. If so, partnerships with magazines with that attract readership about less knowledgeable recreationists may be considered.

A combination of survey methods were used to collect the necessary data of this study. Hearts Content Campground, Hearts Content Scenic Area and Hickory Creek Wilderness Area users were contacted onsite during the summer season (May 25 - Sept. 14) using a two-page personal interview survey methodology with a longer, eight page follow-up mail survey sent respondents who agreed to participate. This methodology reduced the burden on the user while maximizing response rate on the follow-up mailings. Adjacent landowners, equestrian users, other users and other stakeholders that might have been missed in the onsite survey were also sampled through a mail survey methodology. A modified Dillman (1978) approach was used for all mail surveys used in this study. The additional groups receiving a mail survey were identified as:

1. Landowners from a random sample of surrounding landowners from the tax roles acquired from the assessor's office in the two counties, Warren and Forest, adjacent to the study area.
2. Equestrian users were identified from a list of attendees to an equestrian management issues meeting held by the USDA Forest Service the previous year.
3. Additional Wilderness users and stakeholders including hunting and fishing clubs; fire, ambulance, search and rescue associations; scouting groups; wilderness guides and outfitters were obtained from as list of individuals who signed the HCT trail register.

User groups were divided into the following five groups based upon their response to a classification question or from the type of sample: Wilderness Users, Scenic Area Users, Campground Users, Horse Users, and Landowners. The classification question identified users as Wilderness users, scenic area users, or campground users. This classification was based on their answer to the following question, "Which of the following reasons best describes your purpose for visiting this area: to visit the Hickory Creek Wilderness, to visit the Hearts Content Scenic Area, or to camp in the Hearts Content campground?" Of the other user groups, Horse Users were selected from public involvement meetings, Landowners from tax rolls, and additional Wilderness users from trail registers. Each of these groups were asked to: (1) list the number and title of magazines that they regularly read (up to five magazines) and (2) to complete a brief twelve item LNT quiz. This quiz was an adaptation of the one administered by Cole and others (1997), except that some site-specific questions (such as all-terrain vehicle use) were added. Descriptive analyses (frequencies, means), chi-square analyses, and F-tests were the statistical tests used in this research.

Results

The onsite survey of wilderness users yielded a 99% onsite response rate for visitors (N = 269) and its follow-up mail survey yielded a 61% response rate (N = 155). The mail surveys distributed to the additional groups (landowners, equestrian users, and other stakeholders) yielded a 46% response rate (N = 371). Respondents across all user groups indicated that ranger contacts, brochures and trailhead signs were their primary sources of wilderness information (60%, 46% and 40% reporting that they used these resources, respectively). When focusing on offsite, nontraditional outlets, the Internet and magazines were cited as primary sources of information (60% and 29%, respectively). When asked to list magazines that they read on a regular basis, *Backpacker*, *Pennsylvania Game News*, and *Outdoor Life* received the most frequent mention out of a total of 350 different magazine titles cited. Landowners cited the most magazines and campground users the fewest ($F = 15.87$, $p = 0.000$) (table 1).

Based on this list of 330 identified magazines identified, a post-facto classification procedure was then conducted by the authors. The authors examined and classified magazines according to purpose, coverage and theme. From these discussions *and* from using content analysis classification procedures developed in other research (Carlson, Grove and Kangun 1993), a set of meaningful magazine categories was generated based on topic, activity and interest type. Readership of magazine type was not mutually exclusive by user type, but an additional analysis of the data indicated that certain titles of magazines were predominately read by campers, horse users, and backcountry users. Even so, any conclusions and recommendations from this study should be made with this classification issue in mind.

Wilderness users most frequently cited the outdoor recreation (nonconsumptive) magazines as those that they regularly read. Surrounding landowners cited the outdoor recreation (consumptive); scenic area users, the environment; campers, general interest; and, not surprisingly, horse users overwhelmingly read equine sports magazines (table 2). When focusing on readers of the outdoor recreation (non consumptive) magazines (a high proportion of which were defined as wilderness users), results indicated that these readers tended to be the most knowledgeable about general

Table 1—Number of magazines read by user type.

Type of user group	Average number of Magazines[a]	N
Wilderness users	1.8	183
Scenic area users	1.3	62
Campground users	1.1	108
Horse users	2.2	99
Surrounding landowners	2.6	178
All Users	1.9	630

[a]$F = 15.87$, $p = 0.000$.

Table 2—Magazine readership by user type.

Magazine type	Wilderness users	Scenic area users	Campground users	Horse users	Land owners
			-percent-		
Outdoor recreation (nonconsumptive), N = 296	53	5	16	3	23
Outdoor recreation (consumptive), N =G´96	15	2	9	12	61
Environmental/conservation, N = 173	39	19	10	8	23
General news/business, N = 109	29	8	15	9	39
General recreation and fitness, N = 92	34	9	11	13	33
Home and domestic, N = 80	21	8	6	24	41
General interest and entertainment, N = 74	22	8	16	15	39
Equine Sports (N = 132)	4	0	1	84	11
Other/unknown, N = 118	20	5	5	26	44
All respondents, N = 630	29	10	17	16	28
	(N = 122)	(N = 26)	(N = 46)	(N = 83)	(N = 144)

forest information. For example, they were the most likely to name the correct agency responsible for management of the area (86% correctly identified the USDA Forest Service). They were also the most likely to correctly identify the area as part of a National Wilderness Preservation System (82% said that the area was part of NWPS).

Next, user groups were quizzed on their knowledge of LNT practices via a brief battery of true/false questions concerning minimum impact practices and behaviors (table 3). Overall scores indicated that users were more aware of LNT practices on this 12-item quiz, with an average score of 48%, compared with Cole and others (1997) eight-item multiple-choice quiz, with an average score of 33%. However, readers are cautioned that not all quiz items were the same, nor were they presented in the same format. As a result, differences between these two tests may also be a result of the instrument utilized. Readers of the outdoor recreation (nonconsumptive) magazines again demonstrated their wilderness knowledge and awareness with a high proportion (56%) of passing scores (60% or more). However, fewer people from other readership categories received a passing score (only 14% of equine sports magazine readers answered 60% or more correctly) (table 4). Comparisons of LNT scores by the type of user were similar, as wilderness users scored higher (62% score) than landowners and horse users (7% and 13% respectively) (table 5).

Table 3—Leave No Trace quiz items.

True or False…
When hiking and encountering a horse party you should wait until the horses have come to a stop and then move quickly past them.
When camping in obviously impacted areas, you should spread activities to places that have not been disturbed.
I do not need a permit to spend the night in the Hickory Creek Wilderness.
I cannot ride my mountain bike in the Wilderness, because it is not allowed.
If I wanted to ride my ATV in the wilderness, I could do so as long as I stay on the trails.
When hiking in remote, lightly used locations of the Hickory Creek Wilderness, it is best to camp on a site with no evidence of previous use to minimize your impact on the wilderness environment.
Building temporary benches by moving rocks and logs at your campsite is an accepted low-impact behavior.
When traveling on existing trails, it is best to walk single file and stay on the main path to minimize impact.
In the Hickory Creek Wilderness, it is OK to camp in direct view of the trail because the area is so small.
In the Wilderness, you should never camp next to a stream.
When camping in the Hickory Creek Wilderness, how far from a stream or water source (in feet) should you camp? _____ Feet.
When camping in the Hickory Creek Wilderness, how far from an established trail (in feet) should you camp? _____ Feet.

Table 4—Leave No Trace quiz results by magazine type.

Magazine type	Number[a]	Pass %[b]	Mean score[c]
Nonconsumptive	107	56%	6.9
Consumptive	102	32%	5.7
Environmental	66	45%	6.5
General recreation	23	27%	6.0
General news	36	33%	6.6
Home/domestic	27	35%	5.7
General Iinterest	17	24%	5.2
Equine sports	14	14%	4.2
Other/unknown	25	24%	5.0
All respondents	141	33%	5.8

[a] Number of people citing this type of magazine as one thata they read.
[b]60% = Passing score, p = 0.006, Chi-square = 7.50.
[c]p = 0.001, F = 6.76.

Table 5—Leave No Trace quiz results by user type.

User type	N	Pass %[a]	Mean score[b]
Wilderness users	89	62%	7.7
Scenic Area users	11	37%	6.8
Campground users	34	58%	7.8
Horse users	7	7%	3.6
Landowners	23	13%	4.7
All respondents	164	33%	5.8

[a]60% = Passing score, p. = 0.000, Chi-square = 132.99.
[b]p = 0.000, F = 53.72.

Discussion and Implications

Study findings indicate that readership in offsite communications, such as magazines is associated with varying LNT knowledge levels across user groups. Group comparisons show that wilderness users tended to read outdoor recreation (nonconsumptive) magazines (such as, Backpacker and Outside). Given that these readers already had high knowledge and awareness of minimum impact practices, promotional efforts should concentrate on other magazines read by groups who are less involved with and knowledgeable about appropriate behaviors. While it may not be fitting to communicate LNT messages in general interest, home and domestic, and general news magazines, managers may reach a substantial portion of users by using outdoor recreation (consumptive) and equine sport magazines as a communication platform. These magazines attract advertisers whose products are used in the outdoors and who are (or should be) interested in minimizing the impacts of their products on the environment. Such companies could serve as partners in a social marketing campaign designed to communicate the LNT message. In fact, another site-impact campaign, *Tread Lightly!*, has already placed its messages in ATV manufacturer advertisements placed in such magazines (Mowen 1998). Many of the outdoor recreation (consumptive) magazines also have special regional sections. Given that the present study occurred in an Eastern wilderness area, the LNT program could place context specific information in the Eastern supplemental sections of these magazines.

The findings of this study indicated that equine users tended to have lower LNT knowledge levels. This is consistent with the research of Cole and others who found that horse users attended to messages less and had lower knowledge scores. There may be several explanations for this finding.

First, the nature of the LNT questions could be too broadly defined or not relevant for all user groups. A follow-up analysis of this sample indicated that horse users were least likely to cross over into other activities. As a result, it is possible that only LNT practices that affected horse users would catch the attention of this user group. Conversely, it is also possible that those who exclusively hike would probably be unaware of the minimum impact issues related to stock in the backcountry. Perhaps future comparisons of LNT knowledge levels across user groups could incorporate and combine *activity specific* questions with the general knowledge questions.

Second, horse users, as defined in this study, may also not be wilderness users and as a result may not be expected to have higher LNT scores exhibited by hikers who were regular users of the area and other wilderness areas. Third, onsite information currently used to promote LNT may be inadequate to communicate to equine users because the activity of horse riding may make it difficult to read onsite trail messages (Cole 1998). Offsite communications in equine magazines would help relay LNT messages, and, if such messages came from horse users themselves (persuasion through source effects) or if the content of the educational piece was keyed to horse use (persuasion through message effects), the persuasive effectiveness of the knowledge-behavior link might be strengthened. The horse users in this study almost always cited equine magazines as their first magazine and, in many cases, as the only type of magazine that they read. Therefore, any effort to build LNT awareness, knowledge and potential behavior among horse users should emphasize such magazines as a communication platform.

Given that advertising rates can be cost-prohibitive for many natural resource agencies, LNT communications should be targeted toward specific user groups with low awareness and knowledge. This study found that readers of outdoor recreation (consumptive) and equine sports magazines had the lowest LNT scores, while readers of outdoor recreation (nonconsumptive) and environmental magazines had the highest LNT scores. Assuming that the highest scores found are acceptable to managers, efforts to concentrate communications in outdoor recreation (consumptive) and equine sports magazines should be pursued to make the LNT message available to a broader recreation clientele. Certainly, such offsite communications should be used to supplement, not supplant existing onsite signage, workshops and ranger contacts.

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Factors That Limit Compliance With Low-Impact Recommendations

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Abstract—Despite widespread efforts to minimize resource impacts, a number of remote areas continue to suffer from poor backcountry practices. Research to evaluate the effectiveness of low-impact communication strategies as they relate to recall of messages (Cole and others 1997) measured whether or not recreationists were aware of appropriate behavior given certain scenarios; it did not measure actual compliance. Partially in response to the results of that study, it has been hypothesized that a lack of information is not necessarily the only limiting factor in complying with specific low-impact recommendations. We propose a four-stage model of factors that might help to explain some noncompliance with backcountry low-impact recommendations where information is not the limiting factor.

The study of noncompliance with low-impact recommendations may be useful on any number of fronts. Certainly, there is the issue of natural resource degradation from recreation impacts. Soil and vegetative impacts from improper camping techniques or inappropriate trail behavior are all important concerns. Similarly, inappropriate behavior during camping or hiking experiences can lead to impacts on wildlife and water resources. Of course, resource impacts are not the only issue of concern—social impacts too may result from noncompliance with low-impact recommendations. A host of visitor experience issues might arise, such as camping too close to other parties, to the trail or to water can all affect visitor experiences. Issues such as crowding and solitude can be affected by noncompliance. Additionally, improper disposal of human waste can be both a health hazard and can result in a negative recreation experience. Finally, managerial and policy issues might arise as a result of noncompliance where certain areas may be closed or restricted to use due to complaints from other users or severe resource impacts.

Overall, this proposed model should be viewed as an opportunity to understand the social and psychological processes at work within the recreational setting, particularly as they relate to choice and decision factors. This suggests that a number of factors influence our decisions and, ultimately, our behaviors.

Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA) has been widely used to explain behavior in terms of intentions (Figure 1). However, we recognize that a host of other factors may intervene prior to intention that will subsequently affect behavior. Petty and Cacioppo's (1981) Elaboration Likelihood Model (ELM) acknowledged that certain psychological constructs, such as motivation and ability to process information, may affect an individual's attitudes, which in turn, may affect an individual's intentions toward behavior. Each of these examples can be used in the context of noncompliance with low-impact recommendations. With the TRA, we can envision a situation where one's own attitude toward some behavior outweighs a corresponding subjective norm, resulting in noncompliance with some low-impact recommendation. Similarly, under the ELM, an individual may be exposed to some low-impact recommendation through written media on a bulletin board, and, indeed the individual can be considered knowledgeable of specific low-impact recommendations; however, he or she lacks either the motivation or the ability to process that information. The end result in this situation might also be noncompliance. The four-stage model we propose uses the foundations of both the TRA and the ELM, however, we attempt to specify certain sub-categories.

While both the TRA and the ELM offer ways of examining factors that ultimately affect behavior, our proposed model focuses more on the cognitive processes and social forces that affect decision-making. This model builds on both the TRA and the ELM, however the difference lies in the specifics of focus. The first stage of our model focuses on the interpretation of the situation. At this level we are interested in perceptual abilities and familiarity with the meanings environmental stimuli. The second stage of the model examines

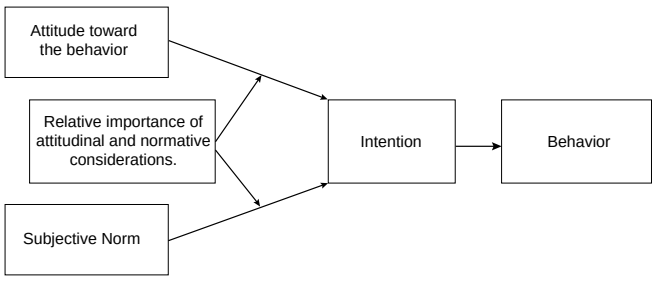

Figure 1—An adapted model of the Theory of Reasoned Action from Ajzen and Fishbein (1980).

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information retrieval strategies. At this level our concern is the accessibility of attitudes, information and beliefs about low-impact behaviors. Moving to the third stage, judgment formation, we are primarily interested in the ethics that guide behavior choice. In the final stage, expressions of behavior represent a final decision-stage with explicit social factors that link behaviors with perceptions of other people. Factors such as social identity guide behavioral decisions, in that, in some instances people perform behaviors so as to be consistent with some positive social identity.

Cognitive psychology is an approach to psychology that emphasizes the study of mental processes (Goldstein 1996); specifically it is concerned with mental processes involving perceptions, pattern recognition, memory retrieval, decision-making and judgment. Some cognitive functions that might come into play in noncompliance situations are a failure to recognize the need for a low-impact decision, misidentification of environmental cues and an inappropriate recommendation retrieved from memory. Social psychology deals with situations where the attitudes, beliefs and behaviors of other people affect our own attitudes, beliefs and behaviors. Much social psychology research "has been framed in terms of conformity" (Eagly and Chaiken 1993) and thus is well-suited to studying issues of noncompliance. In the context of following low-impact recommendations, social psychology might deal with those situations where our camping or hiking companions somehow influence our decisions, judgments and expressions of behavior leading to noncompliance.

Thus, knowledge of appropriate low-impact recommendations is not necessarily the only limiting factor in compliance. Cognitive and social factors can intervene between identifying the need for low-impact practices and, ultimately, practicing the correct behavior. Where recreationists are aware of and have a favorable attitude toward specific low-impact recommendations, other intervening factors, such as group influences, may occasionally prevent compliance.

This model identifies four distinct stages. However, each of the stages relates to at least one of the other stages. Thus, our four-part model details the interconnectedness of each of these parts, and each of these parts is outlined in the paragraphs that follow.

Interpretation of the Situation

The first stage of the model is what we have labeled Interpretation of the Situation. At this stage, recreationists must scan and interpret the physical and social conditions of an area. In this sense, they must be able to identify resource impacts and how other people may or may not affect the recreation experience. A problem occurs when people are unable or unwilling to correctly identify salient physical and social features of a site.

On the one hand, people can misinterpret certain environmental cues that are critical to identifying low-impact recommendations. For instance, when trying to select a campsite, campers might first try to determine the amount of use a site receives and thus the need for low-impact practices. How do they determine whether a site receives low, medium or high use based on visible impacts? This can be very challenging task even for moderately experienced campers. Keep in mind that this is just the first stage in our four-stage model. Unless something in the physical or social environment triggers the need to choose and implement a low-impact practice, recreationists will not enact a low-impact behavior.

One technique that appears to have some application in the identification of salient physical or social features is the Signal Detection Theory. Signal Detection Theory was proposed as part of military training where radar technicians had to correctly identify visual stimuli on their radar screens. In low-impact scenarios, we would likely be most concerned with whether people could identify some appropriate environmental stimulus, such as fragile vegetation or presence of wildlife. The basic premise of signal detection theory assumes that there is a two-way decision with four possible results: Stimulus—Yes, Stimulus—No, Noise—Yes, Noise—No.

The stimulus in this case represents environmental cues that truly occur in reality. Noise represents the absence of a true environmental cue. People respond either with a yes or no when faced with either stimulus or noise. Thus, people can respond either correctly or incorrectly to both stimuli and noise. Typically, we are concerned with a response scenario, which can be translated into "Yes" = perceived stimulus is present and "No" = perceived stimulus is absent. Likewise, there are two possible stimuli scenarios: "Noise" = no stimuli and "Stimuli" = presence of stimuli. Figure 2 illustrates this relationship. The "Quiet" box represents a situation in which the individual correctly observes that there is no stimulus, when in reality a stimulus is absent. The "Miss" box represents a situation in which the individual incorrectly observes that there is no stimulus, when in reality a stimulus is present. A "False Alarm" represents a scenario in which the individual incorrectly observes a stimulus, when in reality a stimulus is absent. Finally, a "Correct Detection" occurs when the individual correctly observes a stimulus, when in reality a stimulus is present. Each of the incorrect assessments has negative ramifications. The "Miss" box is analogous to a Type II error where one fails to identify a true difference. The "False Alarm" box is analogous to a more serious, Type I error where one believes a difference exists when none, in fact, does. However, as we shall see, the relative severity of a negative consequence changes in a low-impact scenario.

A specific example of a low-impact behavior can illustrate the connection. Suppose our behavior is campsite selection where a host of criteria should be employed to choose an optimal campsite. One of these criteria is the likelihood of

		REALITY	
		Noise	**Stimuli**
PERCEPTION	**NO**	Quiet	Miss
	YES	False Alarm	Correct Detection

Figure 2—Standard variables explaining the Signal Detection Theory.

disturbing wildlife. This criterion might be derived by visually observing or hearing wildlife in the area or perhaps observing fresh signs of wildlife (scat, rubbings, tracks, etc.). Any one of these could serve as a stimulus or signal. For illustrative purposes, we'll choose observing animal tracks as a stimulus. Figure 3 illustrates how animal tracks might be used in a signal detection scenario. Consistent with all examples of the Signal Detection Theory, only two of the four possible outcomes result in good or correct decisions. In this example, the two correct decisions would be either correctly selecting a good campsite or correctly identifying a bad campsite. The situation when our camper correctly identified a good campsite, resulted because he/she searched for tracks, but none were present in reality.

In this situation, the camper would presumably select this site to set up camp, assuming all other variables were similarly acceptable. Under different circumstances, the camper correctly identified a bad campsite because he/she searched for tracks and actually found some. In this situation, the camper would presumably continue searching for an acceptable campsite, as the presence of animal tracks would eliminate this one from consideration. The relative severity of an incorrect decision can be seen with this example. The lower left box, which typically represents a "False Alarm" or a Type I error, would result in no additional impact to the campsite because the camper would reject it (albeit for no good reason). Similarly, the upper right box, which typically represents a "Miss" or a Type II error might result in unnecessary damage to the campsite because the camper found nothing wrong using it.

It should be noted that the Signal Detection Theory presumes a situation of high involvement, where the individual actively searches for information or a specific stimulus. Additionally, it is worth mentioning that, particular to the previously mentioned campsite-selection scenario, several different criteria or stimuli would have to be considered before a campsite would ultimately be selected for use. Thus, searching for animal tracks would represent just one of these criteria. Others that might be considered are distance from water, potential to disturb other campers, fragility of vegetation and soil, etc. As most low-impact behaviors are similarly complex, a host of criteria or stimuli would likewise be considered for each one under the signal detection theory. So the question then arises of whether individuals would systematically process each criterion in a signal detection scenario, or would this task prove too complex? Additionally, it is not clear how effectively Signal Detection Theory would handle situations involving multiple criteria. In fact, perceiving only one criterion, in situations where many should be considered, can certainly lead to instances of noncompliance. However, despite these drawbacks, Signal Detection Theory does represent an appropriate concept for the first stage of the model in instances where decisions are relatively non-complex and limited to a singular stimulus.

Information Retrieval Strategies

Concomitant with interpreting the situation comes identifying the need for a low-impact decision, and thus occurs very early in this four-stage model. However, correctly identifying the need for a low-impact decision does not ensure that one will be made. Of paramount concern at this stage is the ability to retrieve salient information about low-impact behaviors from memory. In short, how accessible are our attitudes, information and beliefs about low-impact behavior? Even though we may assume that wildland visitors are well-informed about correct low-impact behaviors, we should not assume that knowledge is completely and accurately retrieved from memory. One way in which a failure in memory may occur is when individuals may be relying on a heuristic, or shortcut, for information retrieval.

According to Taylor and Fiske (1978), we are all "cognitive misers," meaning that we do what we can to simplify mental processes. A heuristic is one method of simplifying mental processes, and one type of a heuristic is the availability heuristic.

An example of this might occur when an individual is attempting to recall the appropriate behavior for more than one person walking across a trail-less open area. One low-impact recommendation is for the individuals to spread out,

		REALITY	
		No Tracks	**Tracks**
PERCEPTION	**NO**	Correct identification of a good campsite	Incorrect identification of a bad campsite
	YES	Incorrect identification of a good campsite	Correct identification of a bad campsite

Figure 3—Using presence/absence of animal tracks and Signal Detection Theory to identify good or bad campsites.

so as to disperse their impacts. However, an individual's most frequent (and hence most available) memory is that of hiking single file, and this becomes their chosen behavior. In this scenario, the individual correctly interprets the situation as one in which a low-impact behavior is appropriate. Further, he or she identifies the need for a low-impact behavior. However, the behavior accessed from memory is not appropriate given environmental conditions. Thus, incomplete or inaccurate retrieval of memory can result in a choice of inappropriate low-impact behavior.

Another way to look at the role of information retrieval strategies is through certain choice rules. Psychologists have distinguished two broad categories of choice rules: compensatory and non-compensatory rules. Abelson and Levi (1985) extensively detail each of these rules. Briefly though, compensatory rules are those where individuals are allowed to adjust and make trade-offs among attributes. Non-compensatory rules do not allow trade-offs between alternatives.

It is worth mentioning that a great deal of cognition research is based on consumer decision-making; the same is true for these two types of choice rules. Studies of choice rules often place individuals in situations in which they are asked to choose one product from two or more alternatives based on a number of different product criteria (for example, cost, features, functionality, etc.). It seems reasonable that many of the low-impact criteria, such as all of those associated with campsite selection, should be substitutable for product-related criteria. An additional point worth mentioning is that all choice rules serve as models only among situations with well-defined alternatives (such as, Campsite A, Campsite B, Campsite C, etc.). In this respect, recreationists must be able to identify and apply the same criteria across each campsite. Similarly, a great deal of study has been given to decision-making in situations in which the alternatives are not so clearly defined (Tversky and Kahneman 1982).

Judgment Formation

How do individuals ultimately act in response to their attitudes, memory, environmental cues and judgments? A number of factors influence our judgments. For example, cognitive (What do I remember choosing last time?) and social-psychological (What would someone important to me choose?) factors direct the decision about the correct behavior.

A critical aspect of choice of behavior is one's ethics. Different models of ethical decision-making exist, such as an ethic of justice and an ethic of care. Carol Gilligan (1982) contrasts these in great detail. For a summary of each, refer to table 1.

Table 1—Comparison between an ethic of justice and an ethic of care.

Ethic of justice	Ethic of care
Reason	Emotion
Necessity	Contingency
Universalization	Particularity
Abstraction	Situatedness

An individual might act according to an ethic of justice if he or she is concerned with equal treatment. An ethic of care promotes equal consideration rather than equal treatment. The distinction between these two can be illustrated with an often-cited ethical dilemma involving two injured people. In this case a doctor roaming through the rubble of an aftermath of an earthquake, comes across two injured people. Each person has a leg injury. While one person has a relatively superficial laceration requiring several stitches, the other person suffers from a compound fracture of the femur. The doctor only has two doses of morphine left and he must deal with both injured people. Under equal treatment, each person would receive one dose of morphine regardless of their relative levels of pain. Under equal consideration, the needs of each injured person would be considered against the needs of the other and the amount of relief available. In this instance, the person with the compound fracture would get both doses of morphine, because his/her pain is more severe and two doses will do more for this person than one will do for each of them.

This distinction is also evident in a campsite selection example. An ethic of justice would promote the position that all campsites should be treated equally regardless of amount of use or environmental condition. Conversely, an ethic of care would promote equal consideration rather than equal treatment. Equal consideration is contextual where the particular characteristics of each campsite would be considered. Campsite selection using an ethic of care would lead the individual to consider the relative merits and impacts of each campsite and act in the best interest of all the campsites.

Ethics are not descriptive, they are prescriptive. That is to say, ethics do not tell us the way the world is—they tell us the way the world ought to be. The difference between "is" and "ought" plays a critical role in many cases where the natural world intersects with policy. It is clear the way the natural world is, but it is not always clear how we ought to behave with respect to the natural world. Low-impact recommendations, themselves, represent a certain type of environmental ethic, and these recommendations may be rooted in an ethic of justice or ethic of care depending on the individual.

Despite the fact that we may use our ethics to determine what we think we ought to do, what we think we ought to do may not always be consistent with low-impact recommendations. Thus, it may be an ethic that produces an inappropriate behavior. Specifically, if the ethic one intends to follow is rooted in equal treatment rather than equal consideration some areas may suffer needless resource damage.

Expressions of Behavior

At this stage of the model, an individual attempts to determine which behavior is most appropriate within the context of both social and environmental factors. Social pressure and social identity come into play, whereby the individual weighs the appropriateness of his or her decision with the image he or she will project to others. This harks back to the Theory of Reasoned Action, in which a subjective norm is one factor that influences behavioral intentions. An example of the Theory of Reasoned Action at work in a questionnaire item might be using a Likert scale to respond to the following statement: "Most people who are important

to me think that I should follow low-impact recommendations at all times."

A specific example of the phenomenon of social identity might be a rock climber who wants to be seen by other climbers as environmentally conscious. His or her behavior is adjusted to be consistent with that image. This climber might go to great efforts to project an "environmentally conscious" image in the presence of other climbers. While the ultimate result of this climber's efforts might be consistent with low-impact recommendations, his/her motivations for following these recommendations are not rooted in any desire to protect the environment. This is important, because in situations where there exists no motivation to project an "environmentally conscious" image, no intention to behave appropriately will be there either.

Specifically, if a recreationist believes that certain behaviors will not be sanctioned by the rock climbing community, there is little normative pressure to comply with a recommendation. Immanuel Kant noted the delicate balance involved in doing what is expected of us. If we do either more or less than is required of us, we can be held accountable for the consequences, but not otherwise. So the burden then shifts to communicating clear and precise low-impact recommendations to minimize any ambiguity about what is expected of recreationists.

Finally, there undoubtedly are situations in which an individual correctly interprets the situation, correctly recalls a recommendation from memory, and the appropriate course of action is clear, yet, this individual still fails to put into practice the appropriate behavior. At this last stage of the model, a range of factors might make compliance with low-impact recommendations difficult or impossible to follow. It is easy to imagine a backpacker who, faced with fatigue or bad weather, decides to set up camp in a less than ideal spot, even though he or she knows better. It also may not be physically possible to carry out "correct behavior"—such as when the only reasonably flat area for camping is within 100 feet of an alpine lake.

So What?

Over 2,000 years ago, Plato developed the term *akrasia* to describe a weakness of will that causes people to do what they know is not right. This concept applies to some situations of noncompliance where people correctly identify appropriate low-impact behavior but fail to carry out this behavior due to convenience or expedience. However, this only represents some instances of noncompliance that occur after cognitive and social psychological evaluations have been made. As illustrated by the first three stages in the model, there are a host of factors, such as situation interpretation, information retrieval, and judgment formation that might limit compliance with low-impact recommendations.

A better understanding of the factors that may limit noncompliance will lead to more effective strategies in behavior modification. Depending on which of the four factors is limiting compliance, managers or community groups might apply different persuasive strategies. For example, if correct interpretation of the situation seems to be problematic, perhaps managers could pursue educational efforts that very clearly illustrate techniques in reading the environment. In those scenarios where individuals seem to have a problem correctly retrieving information from memory, managers could take steps to clarify recommendations and perhaps make sure that these recommendations are introduced through the central route. Where ethics are somehow inconsistent with a proper judgment, perhaps the groups responsible for communicating these messages should redouble efforts at consolidating a cohesive set of outdoor ethics. Finally, where appropriate behavior somehow falls short, even where judgments are successfully interpreted, retrieved and formed, perhaps managers should clarify and emphasize the importance of following low-impact recommendations 100% of the time.

It should be noted that this model remains theoretical at this point. What remains to be done is to evaluate the validity of the model. Indeed, decisions about what exactly qualifies as noncompliance must be made prior to any evaluations of the model. In this respect, it must be very clear what constitutes noncompliance. Is noncompliance a gross disregard for all low-impact recommendations? Or, rather, does noncompliance result when just one recommendation is not followed? Or, perhaps, true noncompliance can only be examined in terms of intention? Answers to these questions must be obtained before any model testing can proceed. However, we suspect a combination of observed behavior coupled with self-reporting will either support or refute the model. The idea is to emphasize different aspects of the model and measure changes in behavior and self-reports. Ultimately, it is hoped that this model will help to clarify subtle distinctions in the reasons for some people failing to practice low-impact behaviors when knowledge of those behaviors is not the limiting factor.

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Attitudes Toward Roles in a Wilderness Education Program

William W. Hendricks

Abstract—This study examined students' attitudes toward the impact monster and the good guy roles in the impact monster skit and determined if attitudes differed by gender and grade level. In addition, differences in high- and low-involvement with the skit were analyzed. The impact monster skit is a popular wilderness education program designed to teach appropriate wilderness behavior and low-impact skills. Results indicate that the students had favorable attitudes toward the "good guy" and unfavorable attitudes toward the "impact monster." Significant differences were found for grade level and gender attitudes toward some message sources. There was no difference in the attitude scores of high- and low-involvement individuals.

Wilderness education efforts frequently involve communication from a source to a recipient. For example, a wilderness ranger may formally or informally communicate appropriate behavior to a wilderness visitor. The message content and/or the message source may cause the recipient to develop favorable or unfavorable attitudes toward the individual delivering the message. This, in turn, could influence subsequent wilderness behavior.

The impact monster skit is a popular and frequently used wilderness education program that relies on the source and content of a message. The skit, designed to teach low-impact skills, typically involves an "impact monster" who demonstrates inappropriate behavior in a wilderness setting and a "good guy" who corrects the behavior (Hendricks and Watson 1999). In a survey of wilderness educators regarding this skit one concern was the perception that the roles played in the skit might encourage stereotyping or inappropriate student attitudes about the roles displayed (Hendricks and Watson 1999). For example, the impact monster might be perceived as being "cool," and students might then engage in wilderness activities modeled after this role rather than the "good guy." The good guy is usually a wilderness ranger or hiker who may or may not be viewed as favorably as the impact monster. This problem was considered more likely in upper grade levels (sixth grade through high school). The purpose of this study was to examine students' attitudes toward the impact monster and the good guy roles within the skit.

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Persuasive Communication

The basis for the study comes from the persuasive communication literature. According to a theoretical perspective based on the Elaboration Likelihood Model, persuasion occurs when communication results in a change in attitudes. These attitudes may guide behavioral processes (Petty and Cacioppo 1986). Two generally recognized communication approaches for messages are the peripheral and central routes to persuasion (Petty and Cacioppo 1981, 1986; Petty and others 1992; Roggenbuck 1992; Roggenbuck and Manfredo 1989). The central route focuses on the recipient's motivation levels and ability to process messages; the peripheral route relies more heavily on message cues, including the attractiveness, credibility, similarity, likeability and trustworthiness of a message source. The importance of the peripheral route is magnified when the cognitive abilities necessary for message processing are inadequate for a central route message. Roggenbuck and Manfredo (1989) suggested that this might be the case with children; therefore, the presenter of a message in a children's wilderness education program or activity needs careful consideration.

Attitudes

A key element of persuasive communication is the attitudes formed through the communication process and the behavior that follows attitude formation or change. Although there are varying conceptual and operational definitions of attitude (McGuire 1985), Vincent and Fazio (1992) have simplified the definition to "the association in memory between an object and an evaluation." Similarly, Petty and Cacioppo (1986) defined attitudes as general evaluation held toward objects (including people and issues).

Attitudes toward an object may result from positive and negative cues associated with a message source (Petty and others 1983). Program recipients may view message sources, including wilderness rangers, peers, wilderness hikers, charismatic individuals and symbolic characters such as Woodsy Owl or Smokey Bear, favorably or unfavorably (Hendricks 1999). Attitudes are likely to develop about these potential sources of a wilderness education message. If wilderness education programs are designed to influence attitudes and behavior, the source of the message may ultimately affect the learning and behavioral outcomes of the program.

Message Recipient

The message recipient is also a critical factor in the success of a persuasive message and attitude change. Among

the message recipient characteristics commonly investigated in previous research are age and gender (Ajzen 1992; McGuire 1985). Results have been mixed in investigations of various recipient variables related to persuasive communication (Ajzen 1992) and environmental education. For instance, Gifford and others (1982) examined the environmental attitudes of college students and found significant differences in gender for knowledge, affect and verbal commitment. Men were more knowledgeable, but women were more verbally committed and expressed greater affect. Differences in attitudes based on age were not significant in the study. When investigating environmental ethics of a wider range of ages (12, 15 and 18 years old), Szagun and Mesenholl (1993) found age differences for consideration of nature, enjoyment of nature and sympathy. Furthermore, females had stronger ethical and emotional attitudes than their male counterparts. In a third study, age and gender both resulted in significantly different knowledge and attitudes toward animals among second, fifth, eighth and eleventh grade students (Kellert 1985).

A more complex recipient variable in persuasive communication research is the level of involvement of the individuals on the receiving end of a message. As individuals become more involved, the amount and type of information processing that occurs may vary (Petty and others 1983). In most cases, high-involvement individuals are more likely to engage in central route processing. Low-involvement individuals are more likely to be influenced by peripheral cues. Contrary to the expected results of one study, Petty and Cacioppo (1980) found that a peripheral message source was just as effective with low- and high-involvement recipients.

Behavioral Intentions

Whereas the Elaboration Likelihood Model emphasizes the attitude changes that occur within the persuasive communication process, the Theory of Reasoned Action (Ajzen and Fishbein 1980) links attitudes to behavior through behavioral intentions, attitudes and beliefs. The attitudes are toward the behavior; another concept in the theory, subjective norm, refers to what a significant other thinks about the behavior performance or the motivation to comply with this individual. This theory and the Elaboration Likelihood Model's emphasis on message sources for a peripheral route might indicate that attitudes toward a message source help determine behavioral intentions.

Methods

The subjects participating in the study were 574 first, third and sixth grade students in 24 elementary school classes in the central coast area of California. This area borders the Los Padres National Forest, which contains 10 designated wilderness areas. The classes were selected based on availability and similarity of students among the schools. The students live in smaller communities (population under 6,600), with English being the first and primary language of nearly all students. Once classes were selected, they were randomly assigned to treatment groups. As a portion of a larger study, one aspect of the treatments involved messages communicated from varying sources (roles).

The randomly assigned message sources within the treatments represented an impact monster dressed as "cool" in brightly colored clothing or as a "typical" wilderness hiker and the good guy dressed as a wilderness ranger or wilderness hiker. Thus, there were two levels for each of these message source variables toward which students might have favorable or unfavorable attitudes.

Independent variables were gender and grade level. Grade levels were, again first, third and sixth grade students. There were 200 (34.8%) first graders, 202 (35.2%) third graders and 172 (30.0%) sixth graders in the study.

In a separate analysis, high and low involvement with the skit was treated as an independent variable. Before the skit began, eight students were randomly selected to play skit characters of three rocks, a frog, a snake, a tree, a sign and a flower in each of the 24 classes (192 total students). These students were considered high-involvement individuals. The students observing the skit were considered low-involvement individuals.

Attitudes were measured with a five-item, five-point scale containing bipolar adjectives. In a pilot study with a single class from each grade level, a modification of an attitude scale used by Morgan and Gramann (1989) was employed. It was discovered that the first and third grade students had difficulty responding to the scale, raising concerns about the validity of their responses. The scale was then modified by using a variation of a face scale (Andrews and Withey 1976) to represent each point between the bipolar adjectives. The five pairs of adjectives were good/bad, uncool/cool, icky/neat, wonderful/terrible and gross/super. The alpha coefficient to determine inter-item reliability for the scale was 0.81.

Following exposure to the skit, the students were given the scale and asked to complete it by indicating their feelings toward the message sources. As a class, they were taken through each item of the scale independently and asked to respond to one item at a time. The explanations of the scale items were provided to the class by a narrator dressed in an U.S. Forest Service volunteer uniform. The same research assistant played this role each time the skit was performed. A second research assistant held up an enlarged copy of the scale that was used as a visual aid during the explanation.

A 2 x 3 factorial ANOVA was employed. Data analysis included an examination of overall attitudes toward a message source, regardless of the level (ranger or hiker), and an examination by each level. Differences in grade levels and gender were also analyzed. In addition, a secondary analysis with a Pearson's product-moment correlation was used to determine if a relationship existed between behavioral intention scores following exposure to the skit and attitudes toward the impact monster and good guy roles. The behavioral intention scores were derived by asking the students to indicate, by circling behaviors on an illustration, the "activities they would do the next time they went camping in a wilderness." This follows a format similar to the measurement of behavioral intentions in previous recreation resource management literature. Typically, subjects are asked, using a Likert-type scale how likely they are to do something (Trafimow and Borrie 1999; Young and Kent 1985) or what they plan to do (Dowell and McCool 1985). Eleven inappropriate and six appropriate behaviors were possible. Inappropriate behaviors were coded negative one, and appropriate behaviors were coded

positive one; thus, scores could potentially range from negative 11 to positive 6 (see [Hendricks 1999] for further description of the instrument and procedures). A final analysis included attitude differences of high- and low-involvement individuals.

Results

For overall attitudes toward the good guy source of a message, there was a significant interaction between grade and gender $F(2, 550) = 6.53$, $p < 0.002$. Main effects for grade level $F(2, 550) = 4.23$, $p < 0.015$ and gender $F(1, 550) = 11.76$, $p < 0.001$ were also significant (table 1). The total sample aggregate attitude mean score was 24.09 for the five-scale items. Grade levels were 24.09, 24.40, and 23.72 for first, third, and sixth grades, respectively, with a significant difference between third and sixth grade scores. Girls (24.44) had a significantly more positive attitude than boys (23.77) overall and at the sixth grade level.

There was also a significant interaction for the wilderness ranger level of this role variable $F(2, 262) = 59.79$, $p < 0.001$ (table 1). Main effects were again significant for grade level $F(2, 262) = 4.36$, $p < 0.014$ and gender $F(1, 262) = 7.14$, $p < 0.007$. Differences in mean scores were present for first (24.20) and sixth grade (23.23) and third (24.37) and sixth grade. Once again, girls' scores (24.38) were significantly greater than boys (23.61) overall and in sixth grade.

The wilderness hiker level of the good guy message did not result in significant main effects or an interaction effect (table 1). Mean scores were 23.96, first grade; 24.43, third grade; and 24.20, sixth grade. Girls and boys scores were 24.49 and 23.94, respectively.

In overall attitudes toward the impact monster role, main effects for grade level $F(2, 551) = 3.63$, $p < 0.027$ and gender $F(1, 551) = 31.58$, $p < 0.001$ were significant, but an interaction effect was not present (table 1). There was a significant difference between first (8.64) and sixth grade scores (7.36). Sixth grade and third grade (7.73) had the more desirable lower scores. The higher the score, the more positive the attitude toward the impact monster, which is not the favorable response in this case. Overall, boys (8.87) had more positive attitudes than girls (6.88) toward the impact monster. There was also a significant difference in gender at each grade level.

Main effects for grade level $F(2, 303) = 4.43$, $p < 0.013$ and gender $F(1, 303) = 19.61$, $p < 0.001$, but not an interaction effect, were also significant when examining attitudes toward the cool impact monster (table 1). First graders (9.23) had a more positive score than third (7.73) and sixth (7.20) graders, and boys (9.09) had a more positive score than girls (6.91). Significant differences were also present between boys and girls in first and third grades.

The wilderness hiker/impact monster treatment resulted in a significant difference in the gender main effect $F(1, 242) = 13.05$, $p < 0.001$(girls, 6.85; boys, 8.60), but not the other effects. Grade level scores were first grade, 8.04; third grade, 7.73; and sixth grade, 7.54, with a significant difference exhibited for third grade boys and girls.

A secondary analysis investigated the relationship between role attitudes and low-impact camping behavioral intentions after the skit. There was a significant negative correlation (–0.30) between attitudes toward the impact monster and behavioral intentions following the skit. A significant positive correlation (0.22) existed between attitudes toward the good guy and behavioral intentions following the skit. A breakdown of grade and gender levels provided further insight. The correlation of impact monster attitudes to behavioral intentions increased to –0.41 for first grade girls, –0.55 for sixth grade boys and –0.41 for sixth grade girls. The relationship between attitudes toward the good guy and behavioral intentions improved to 0.32 for first grade girls, 0.52 for sixth grade boys and 0.55 for sixth grade girls. There was also a significant negative correlation (0.49) between attitudes toward the impact monster and attitudes toward the good guy.

A final analysis of the data examined differences in high and low involvement with the skit (table 2). There were no significant differences in attitudes toward the message sources, based on students who played roles in the skit (high-involvement) and those who simply observed the skit (low-involvement).

Discussion

The results of the study may assist in adopting more appropriate roles within the impact monster skit to discourage unintended attitudes and behavioral intentions. Overall attitudes toward the impact monster and good guy are in the desired directions. The results are the reverse of what would be expected according to wilderness educators' perceptions of attitude problems in the skit (Hendricks and Watson

Table 1—Attitudes toward the good guy and impact monster.

Attitude variable	First grade			Third grade			Sixth grade			Total gender	
	M	F	Total	M	F	Total	M	F	Total	F	M
Good guy											
Overall	24.10	24.08	24.09	24.21	24.60	24.40[a]	22.71*	24.56*	23.73[a]	23.77*	24.44*
Ranger	24.36	23.95	24.20[b]	24.24	24.50	24.37[c]	21.88*	24.65*	23.23[bc]	23.61*	24.38*
Hiker	23.82	24.21	23.98	24.18	24.70	24.43	23.74	24.49	24.20	23.94	24.49
Impact monster											
Overall	9.37*	7.61*	8.64[a]	8.84*	6.52*	7.73	8.18*	6.67*	7.36[a]	8.87*	6.88*
Cool	10.21*	7.70*	9.23[bc]	8.64*	6.75*	7.73[b]	8.13	6.52	7.20[c]	9.09*	6.91*
Hiker	8.46	7.51	8.06	9.18*	6.11*	7.73	8.23	6.85	7.53	8.60*	6.85*

[a,b,c] Indicate significant differences $p < 0.05$ between grade levels for each message source variable.
*Indicates significant differences $p < 0.05$ between boys and girls at a grade level or overall.

Table 2—Good guy and impact monster role involvement attitudes.

Attitude variable	Good guy		Impact monster	
	Mean score	Significance	Mean score	Significance
Overall				
Role playing	24.07		7.69	
Observer	24.10	.898	8.04	.342
Wilderness hiker good guy				
Role playing	24.28			
Observer	24.17	.718		
Wilderness ranger good guy				
Role playing	23.86			
Observer	24.02			
Wilderness hiker monster				
Role playing			7.34	
Observer			8.01	.204
Cool monster				
Role playing			7.99	
Observer			8.06	.891

1999). Although upper grade students may exhibit overt behavior indicating the impact monster is cool, these results suggest that they are developing appropriate attitudes.

Of notable concern are the attitudes of boys. Boys' attitudes are inferior to girls in most analyses. This may be due to the nature of the impact monster skit and the attempt to persuade the students to indicate that they will behave in an ethical or appropriate manner. Previous research suggests that girls have higher levels of ethical concern for the environment (Szagun and Mesenholl 1993). Willingness to minimize impacts probably includes empathy toward the environment and ethical behavior that may have indirectly been manifested in the results of this study.

Boys and girls have higher scores with the wilderness hiker than the wilderness ranger, so a role played by someone perceived as a peer may be more effective than someone considered an authoritarian figure. This was particularly apparent for sixth grade boys. These results indicate that similarity or likeability (Petty and others 1983) of the message source may be an important characteristic within the skit. One plausible explanation for the gender differences in source attitude scores may be related to the gender of the message sources. The wilderness ranger/hiker was a woman, and the impact monster was a man. Reversing these roles may have influenced the attitudes by gender.

Although relationships between role attitudes and behavioral intentions are significant, the moderate correlation coefficients bring into question the actual practical relationship. It is obviously unlikely that behavioral intentions can be predicted from this variable alone, and that was a rationale for calculating correlation coefficients rather than conducting a regression analysis. Nevertheless, the coefficients for sixth grade students show promise for future research in this area. Further analysis needs a more complete model of the persuasive communication factors in order to rationalize a link between these two variables within the skit.

At this point, wilderness educators should continue to use the program considering the roles of each player in the skit. It would be advantageous for these educators to informally or formally view the behavior of boys and girls to determine if the inappropriate behaviors observed (Hendricks and Watson 1999) are due to the skit or classroom management problems. It might also be helpful to use peers or various wilderness users in impact monster and good guy roles.

We are beginning to get a handle on the effectiveness of the impact monster wilderness education program as it continues to be used by federal agencies. Additional attention should be given to the various scripts and roles used for the skit. Attempts should also be made to ascertain the effects of the skit on actual behavior. Behavioral intentions, message content and message sources have been examined elsewhere (Hendricks 1999); exposure to the skit has improved knowledge of wilderness education behavior (Tracy 1995); and the perceived effectiveness of the program is now documented (Hendricks and Watson 1999). Nevertheless, a statement posed by one wilderness educator still looms over the needed research: "The kids have a great time with it—just can't tell if it is making a difference" (Hendricks and Watson 1999).

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Communicating Minimum Impact Behavior With Trailside Bulletin Boards: Visitor Characteristics Associated With Effectiveness

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David N. Cole

Abstract—Bulletin boards are a frequently used method of communicating minimum impact behaviors to wilderness visitors. But how effective are they? What types of visitors are most likely to pay attention to the messages posted there? This study used a field experiment to identify visitor characteristics associated with attention to minimum impact messages posted on a bulletin board located along a heavily used trail into the Selway-Bitterroot Wilderness. The results indicated that the bulletin board was most effective for hikers and overnight users. Personal utility of the messages posted on the bulletin board was one reason that such users, rather than horse riders or day users may attend to them.

With a generally accepted objective of minimizing human-induced recreational impacts on the biophysical and social character of wilderness environments, managers continue to rely on trailside bulletin boards to communicate important messages to visitors. Reduced budgets and a resulting smaller presence in the field mean that such bulletin board messages are increasingly significant in the repertoire of communication tools. Bulletin boards are relatively inexpensive to place and maintain, and are highly adaptable as locales for new messages and information. Since most visitors must pass by bulletin boards when placed at trailheads or along trails, the potential audience for the messages placed on them includes virtually all wilderness visitors.

Bulletin boards are enormously popular with wilderness managers. Douchette and Cole (1993) report that bulletin boards are used in at least 67% of wilderness areas. Bulletin boards are used to communicate information important to both visitors and managers, including rules and regulations regarding visitor use, warnings of fire and wildlife dangers, orientation to the area, descriptions of the areas through text, photographs and maps, and appropriate visitor behavior for reducing biophysical and social impacts. Managers often view bulletin boards as a cost-effective method of transmitting a wide variety of necessary information, but the boards can easily become cluttered with visually conflicting messages.

A major purpose of bulletin boards is to communicate messages about minimum impact behaviors. Despite their frequent use by wilderness managers and their immense potential audience, little is known about the ability trailside bulletin boards to capture the attention of passing wilderness visitors, effectively communicate minimum impact messages, change behavior, and generally reduce biophysical and social impacts. Although attempts to educate visitors about minimum impact behavior have expanded and improved over the last two decades, knowledge about this topic remain relatively low. Cole and others (1997), for example, report that the average score on an eight-item minimum impact behavior quiz varied from 16% when there were no messages on a trailside bulletin board to 42% when eight messages were present.

Placing messages on trailside bulletin boards implicitly assumes that travelers passing by will stop, attend to, process and respond to the message. However, a variety of intervening variables and processes mitigate the assumed effectiveness of such messages. Given the system-wide investment in trailside bulletin boards and the implicit assumptions about their capabilities, understanding the factors that influence their effectiveness would seem critical to programs emphasizing visitor education.

Variables influencing effectiveness may be broadly characterized as message, visitor, and situational characteristics. Message characteristics include design parameters such as color, size, length, number and placement of the message. Other important message attributes involve message content, the nature of the persuasive argument used, and message source characteristics. Situational characteristics involve not only the specific site of the bulletin board, but the social and behavioral context that affects decisions to engage in minimum impact behaviors. Visitor characteristics that may be influential when trying to encourage minimum impact behaviors include attributes of the visit itself (length of stay, for example), social-demographic background of the visitor, previous experience and level of knowledge and a host of social-psychological variables, such as involvement, motivation and existing belief systems). Ideally, each of these attributes is considered in a systems context when developing appeals to a specific audience, thereby increasing the probability that the message will be received, considered, adopted and acted upon.

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While managers can control message attributes through appropriate design and production, they have little control over the visitor and situational characteristics that influence message effectiveness. Messages on bulletin boards are read at the whim of the potential audience. Messages wait passively for visitors to attend to them, often in settings with a variety of environmental attributes that compete for the visitor's attention. Understanding which visitor variables influence effectiveness in this environment can help managers develop and place messages that are more appealing and more compelling.

In this paper, we focus on visitor characteristics that are associated with attention to, comprehension of and knowledge gained from messages placed on trailside bulletin boards. We do so because understanding the characteristics of one's audience is perhaps the most critical component of developing effective persuasive appeals. In the research reported here, we examine four specific kinds of visitor characteristics: 1) those that characterize the wilderness visit itself (length of stay, travel method); 2) social-demographic characteristics (age, sex, educational level), 3) perceived knowledge of minimum impact behavior and frequency of seeing information about appropriate behavior; and 4) previous wilderness experience. We test relationships between these independent variables and the following dependent ones: exposure to the bulletin board, attention visitors pay to minimum impact persuasive messages, comprehension of message content and changes in minimum impact knowledge. Finally, we discuss the implications of our findings for future research and management.

Framework

Research in communication and attitude theory has identified numerous visitor variables such as affect, involvement, perceptions of source credibility, prior existing beliefs, perceived message saliency and others that mediate the communication process (Vander Stoep and Roggenbuck 1996). Each variable may play a significant role in determining the saliency of a specific persuasive message, the extent to which a visitor attends to the message, how it is interpreted and integrated into the visitor's belief system and, finally how a visitor acts on the message during a wilderness experience.

Messages placed on bulletin boards may be viewed as persuasive messages calculated to encourage visitors to adopt a group of behaviors designed to reduce the biophysical and social impacts of recreation. The effectiveness of these messages may be defined in a variety of ways including increase in awareness of biophysical and social impacts, change to a sanctioned behavior, and an enlarging knowledge base about the principles describing relationships between behavior and impact.

The effectiveness of persuasive messages in a variety of contexts has attracted a large number of researchers, who have conducted an enormous number of investigations into both personal and message characteristics that influence their efficacy. Many of the resulting models of persuasion and applications to wilderness and dispersed recreation management situations are summarized by Vander Stoep and Roggenbuck (1996). However, these models implicitly assume that message location and design are attractive enough that audience members will attend to the message. In fact, many minimum impact messages are relatively passive in their placement—in brochures and on bulletin boards—calling into question this implicit assumption. McGuire's models of information processing suggest that message exposure through attention and processing of content is fundamental to achieving desired behavioral change (McGuire 1976;1985). His approach to information processing forms the basis of the research reported here (one version of his model is shown in figure 1). McGuire argues that persuasion begins with exposure to information—in this study, with the presentation of minimum impact messages on a bulletin board.

Exposure and attention to the message—viewing and reading the persuasive message—is essential to all further information-processing steps, including decisions to adopt the recommended minimum impact behaviors. The process of attending to messages placed on trailside bulletin boards consists of several sequential and distinctive decisions on the part of the visitor. Information-processing theory states that these decisions will be influenced by specific visitor characteristics. (Message characteristics are also influential, but this study examines only visitor characteristics.) Wilderness visitors who encounter a bulletin board along a trail make three decisions related to exposure and attention to these messages.

The first decision involves whether to stop at the bulletin board. If visitors pass the board without stopping, they will not be exposed to the persuasive appeals located there, and consequent behavior change will not occur. This means that the bulletin board must be located in a position where few

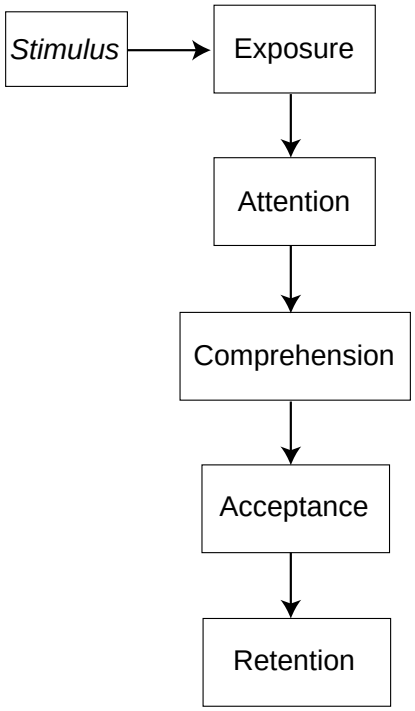

Figure 1—Representation of information processing for persuasive messages (adapted from McGuire 1976).

other attributes compete for the visitor's limited attention. Petersen (1985) found that a wilderness trail registration sign was most effective located some distance from the trailhead, apparently because there were few competing distractions. In addition, the bulletin board must contain obvious visual clues that messages located on it are salient to the visitor's needs or experience. Cole (1998), however, found that relatively elaborate such appeals (such as "avoid the need to restrict wilderness use") were less effective in getting visitors to stop than a simple request ("please take the time to read these messages"). Cole and others (1997) used a large-scale topographic map of the area placed on one of the bulletin board panels to increase the saliency of the messages.

The second decision concerns whether visitors who stop at a bulletin board will attend to the minimum impact messages placed there rather than other potentially competing messages. Bulletin boards are notorious for numerous messages carelessly clumped together, each of which compete for limited attention and provide a distraction from the others. Visitors must select from this aggregation a specific message or set of messages to read within a limited time period.

After deciding which messages to attend to, visitors decide how much time to spend on the messages. These decisions are probably made without much significant thought and are most likely affected by both message characteristics (such as clarity and simplicity) and visitor characteristics (Tykocinski and others 1994). The decision about how much attention to give to messages is important because minimum impact messages are not necessarily simple, and visitors may need to elaborate on them for understanding and later application (Petty and Cacioppo 1986).

Attention to message content should lead to better message comprehension—can the visitor recall the message?—and to higher levels of knowledge about minimum impact behavior, changes in knowledge levels and, ultimately, to behavioral changes.

Several studies have examined the role of personal relevancy or utility as a primary factor influencing attention to persuasive messages (Roser 1990; Tykocinski and others 1994; Pratkansis and Greenwald 1993). Minimum impact messages probably have more relevance for people on extended trips—such as overnight camping trips—because such messages deal with several of the behavioral aspects of the trip. Thus, we anticipate that overnight visitors would more be more likely to stop at the bulletin board than day trippers.

Lucas (1985) suggests that visitors with higher levels of education have more capacity to process and apply complex messages than visitors with lower levels. Therefore, visitors with higher levels of education should attend to persuasive messages on the bulletin board than other visitors. Sex and age of the visitor may also be associated with the decision to attend to messages, but we have no *a priori* reason to believe that one sex would be more likely to stop than the other or that younger visitors would be more or less likely to stop than older visitors.

Exposure to bulletin board messages occurs within the larger context of off-site wilderness related information (such as television and print media coverage). Wilderness visitors may be frequently exposed to minimum impact messages both off-site and on previous visits and thus have become habituated to messages about reducing impacts. Habituation of message content may directly affect a visitor's propensity to attend to minimum impact messages on a trailside bulletin board (Cacippo and Petty 1979; Engel and others 1990). Thus, visitors who have been frequently exposed to such information should be less likely to stop at a trailside bulletin board and pay attention to its persuasive messages.

Previous wilderness experience is another variable that may influence attention to minimum impact messages. More experienced visitors tend to have different information needs than less experienced ones (Krumpe and Brown 1982; Roggenbuck and Berrier 1982; Williams and Huffman 1986). Experience may one method to measure involvement—which in this study could be defined as the intrinsic personal relevance of wilderness issues. Several researchers have noted that the motivation and capacity to process information increases with involvement (Celsi and Olson 1988). This would lead one to expect more experienced visitors to be more likely to attend to minimum impact messages. But more experienced visitors may also be more attuned and habituated to these messages and one could argue less likely to attend to them. Again, the personal utility of minimum impact messages may be less for more experienced visitors.

Age, sex and travel method should have little impact on decisions to read minimum impact messages (unless the messages deal with minimizing impacts of specific travel methods). While travel method has been found to be a variable associated with message attention in previous studies of wilderness visitors (Petersen 1985; Cole 1998; Cole and others 1997; Hammond 1994), we have no *a priori* conceptually based reason to anticipate that horse users or hikers would be more likely to stop at a bulletin board that displayed minimum impact behavior messages.

Attention to messages is critical to comprehending message content and improving knowledge about minimum impact behaviors. Comprehension should be correlated positively with time spent viewing messages, but would also be associated with motivation and capacity to process messages (that is, personal relevancy and prior knowledge). Age, sex or travtN method should not be associated with comprehension. Educational attainment should be positively correlated with comprehension, because of increased capacity to understand messages. Frequency of exposure to information would be positively correlated with comprehension, because the messages displayed on the bulletin board would be easier to incorporate into a pre-existing belief system. Previous experience would positively affect comprehension. Overnight campers would report higher levels of comprehension due to the higher personal relevance of the messages.

Does exposure to minimum impact messages increase knowledge of those behaviors? Knowledge (or beliefs) appear to be an immediate antecedent for intended behavior (Fishbein and Manfredo 1992). Increasing knowledge which leads to changes in behavior seems to be an important goal of minimum impact persuasive messages. However, more knowledgeable visitors are likely to feel that they do not need any additional information, and thus we would expect that as knowledge levels increase, motivation to search for new information decreases. As knowledge increases, ability to process new information also increases (Petty and Cacioppo 1986). Thus, visitors with higher existing levels of knowledge

and greater previous exposure to minimum impact messages should have higher knowledge levels, even though they may spend less time attending to messages. We expect education to be positively correlated with knowledge because of higher capacity to process message content. Finally, we expect knowledge to be positively correlated with comprehension.

Methods

Visitors to portions of the Selway-Bitterroot Wilderness located in Montana participated in an experiment involving several bulletin board treatments in 1995. An experimental bulletin board was established approximately 1.5 miles up the trail from the trailhead. This location was chosen to minimize the number of potentially distracting environmental attributes, like those confronting bulletin boards located in parking lots. In addition, Petersen (1985) found that a trailside registration sign received the greatest attention and response when it was located along the trail a similar distance from the trailhead.

The bulletin board consisted of two four-by-four foot panels placed roughly parallel to the trail in a shallow "v-shape." The treatments included varying numbers of minimum impact messages (treatments consisted of 2, 4, 6 and 8 messages) and an attractor (a local topographic map displaying the watershed and trails), either with no messages or with four messages.

Visitors were observed with an infrared beam-activated film recorder as they approached the site of the bulletin board along the trail. When the beam was interrupted by the passage of a group, the camera recorded one frame every four seconds for four minutes; thus, the amount of time spent attending to the bulletin board could be estimated from the film. Recorded were each group attending to the bulletin board, the particular panel they attended to, and the length of time they spent examining the messages on it. Characteristics such as travel method, day or overnight visitor were noted at the time. After they completed their trip into the Wilderness, a subsample of visitors was asked to complete a short questionnaire. Respondents were asked to note their age, sex, and level of educational attainment and then self-assessed their previous exposure to minimum impact messages and level of knowledge. The sampling process observed 453 people at the bulletin board; 202 of these completed these questionnaires. Comprehension was measured by asking respondents to recall what messages they had viewed during their visit. Respondents' score on an eight-item minimum impact quiz served as a measure of knowledge. Previous wilderness experience was measured by asking respondents about how many previous visits to Bitterroot canyons they had made, how many different wildernesses they had visited, their total number of visits to wildernesses, and about how many visits they make to wildernesses per year.

Results

The focus of this analysis is to associate specific visitor characteristics with each of the three decisions about bulletin board messages and the comprehension and knowledge outcomes.

The Decision to Stop at the Bulletin Board (Exposure)

Overall, about 64% of the visitors we observed stopped at the bulletin board (table 1). For only two visitor characteristics were differences statistically significant at alpha <=.05. Hikers were much more likely to stop at the bulletin board (85%) than horseback riders (30%), as suggested by previous empirical work. Visitors on overnight trips (73%) were more likely to stop than those on day trips (63%), supporting our expectation based on the assumption that the messages posted were more relevant to overnight visitors. Those who stopped were younger than those who didn't stop, but the difference was minimal (alpha = 0.1). Sex and educational level attained were not associated with the decision to stop

Table 1—Percentage of visitors stopping at trailside bulletin board for two different measures of experience.

Travel method**	Hiker (n=254)	Horse rider (n=132)		
Percent	85	30		
Type of Use**	Overnight (n=133)	Day (n=253)		
Percent	73	63		
Self-assessed amount of experience*	Not at all (n=9)	A Little (n=30)	Somewhat (n=84)	Very (n=49)
Percent	67	74	76	74
Number of wilderness Visits/year*	Less than or equal to 1 (n=30)	2-5 (n=72)	6-10 (n=27)	>10 (n=43)
Percent	77	76	74	67

*Differences statistically significant at alpha = .10, using a chi-square test.
**Differences statistically significant at alpha = .05, using a chi-square test.

at the bulletin board. Self-reported wilderness experience and number of wilderness visits per year were associated with the decision to stop, but the findings are conflicting (table 1).

The Decision to Look at Minimum Impact Messages (Attention)

About 70% of those stopping at the bulletin board attended to the messages placed there, as opposed to looking only at the map. The only variables statistically associated (alpha <= .05) with this decision were previous experience, as measured by self-assessment and number of wilderness visits per year. At alphas between .05 and .10, the number of total visits to wilderness and number of wilderness areas visited (see table 2) were also significant. As expected, all four of these variables suggest that experienced visitors are more likely to attend to minimum impact behavior messages than inexperienced visitors.

Amount of Time Spent Attending to Minimum Impact Messages (Attention)

Visitors did not devote much time attending to the minimum impact messages. For the sample as a whole, visitors spent an average of about five seconds attending to each of the displayed messages. The experiment included treatments with different numbers of messages. Six variables were statistically associated with differences in per message attention, but none of these was in the direction expected. Hikers spent more time than horse riders attending to messages (table 3). Age was negatively correlated with per message attention, but the relationship is not straightforward. Respondents who felt they were very frequently exposed to minimum impact messages spent more time looking at the messages than those with less previous exposure, although the major difference is with the group most highly exposed. Those with less prior experience both generally and in the Bitterroot canyons spent more time attending messages, perhaps because they found the messages more useful.

Message Comprehension

Respondent message comprehension scores were correlated with the messages posted during their visit. As expected, overnight visitors reported a higher comprehension (alpha = .06) of message content than day users (table 4). The comprehension levels of hikers and horse riders differed significantly (alpha = .01), with hikers comprehending more of the message content than horse riders. Males and younger visitors had higher comprehension scores than females and older visitors (alpha = .01 for both). Visitors with less experience in Bitterroot canyons had higher comprehension scores than more experienced visitors, counter to expectations. We had expected that general wilderness experience, education and prior knowledge would be related to comprehension, but they were not.

Knowledge

Overall, knowledge about minimum impact behaviors was low: On average, respondents scored about 32% on the knowledge quiz. As expected, overnight visitors and those with higher self-reported wilderness experience and knowledge about minimum impact behavior had significantly higher (alpha <=.05) knowledge levels than day users and less experienced and knowledgeable visitors (table 5). We had expected that education, general wilderness experience and frequency of exposure to minimum impact behavior messages would be associated with knowledge. They were not. Moreover, prior experience in the Bitterroot canyons was negatively correlated with knowledge. Travel method (hike or horseback) and sex demonstrated significant

Table 2—Characteristics of visitors that stopped at the bulletin board choosing to attend to messages posted there.

Self-assessed experience With wilderness travel**	Not at All (n=5)	A Little (n=21)	Somewhat (n=58)	Very (n=34)
Percent	80	91	91	91
Wilderness visits per year**	Less than 1 (n=20)	2-5 (n=51)	6-10 (n=20)	More than 10 (n=26)
Percent	85	92	95	92
Average number of Wildernesses visited for those who*	Attended to Messages (n=103)	Did not Attend Messages (n=11)		
	11	4		
Average number of total Wilderness visits for those who*	Attended to Messages (n=103)	Did not Attend Messages (n=10)		
	31	16		

*Differences statistically significant at alpha = .10.
**Differences statistically significant at alpha = .05.

Table 3—Mean amount of time, in seconds, attending to minimum impact messages (on a per message basis) for variables with significant differences (includes only those visitors stopping at the bulletin board and attending messages).

Age category*	18-20 (n=22)	21-35 (n=33)	36-55 (n=38)	> 55 (n=11)
mean, s.e.	6.0 (0.7)	5.3 (0.8)	4.2 (0.5)	5.8 (1.3)
Frequency of Exposure To Minimum Impact Messages**	Never (n=7)	Not Frequently (48)	Frequently (n=44)	Very Frequently (n=6)
Mean, s.e.	4.8 (1.0)	4.7 (0.5)	4.8 (0.5)	9.7 (3.1)
Prior visits to Bitterroot canyons**	1 (n=34)	2-5 (n=17)	6-20 (n=24)	> 20 (n=32)
Mean, s.e.	5.4 (0.6)	7.3 (1.0)	4.1 (0.7)	4.2 (0.7)
Wilderness visits Per year**	<2 (n=17)	2-5 (n=47)	6-10 (n=19)	> 10 (n=24)
Mean, s.e.	4.6 (0.7)	6.1 (0.6)	3.1 (0.5)	5.0 (0.9)
Total Wilderness Visits**	<3 (n=10)	3-15 (n=43)	16-60 (n=32)	> 60 (n=18)
Mean, s.e.	6.2 (1.3)	5.7 (0.6)	4.0 (0.5)	4.6 (1.1)

Age, visits to Bitterroot canyons, and total wilderness visits were originally measured at the interval level, but data is shown in categories for ease of interpretation.

*Differences statistically significant at alpha = .10.
**Differences statistically significant at alpha = .05.

differences in knowledge—variables for which we had not expected differences.

Does exposure to more messages lead to gains in knowledge? To address this question, we examined interactions between the number of messages to which the visitors were exposed and each of the independent variables examined in this study. We found significant interaction with three visitor characteristics. To assess the magnitude of knowledge gained as exposure to number of messages increased, knowledge scores were regressed against the number of messages presented for each level of the independent variables. Larger regression coefficients (regression line slopes) indicate a greater gain in knowledge with increasing numbers of messages. Steeper slopes represent greater capacity to process messages and integrate them into one's existing belief system. Day users, college graduates and those with many previous visits to the Bitterroot canyons show the highest regression coefficients, suggesting they learn more from exposure to increasing numbers of messages than overnight visitors, those with lower levels of educational attainment, and visitors with less previous experience in the Bitterroot canyons (table 6). Although day users and locally experienced visitors paid less attention to the messages, the data suggest they gained more knowledge when they did attend to the messages. Spearman's rho correlation coefficients show significant positive relationships between mean per message attention time and comprehension (.526) and between comprehension and knowledge (.480).

Table 4—Mean message comprehension for study respondents attending to messages posted on the bulletin board, in percent.

Travel method**	Hiker (n=92)	Horse rider (n=15)		
Mean, s.e.	56 (3)	15 (5)		
Type of Use*	Overnight (n=46)	Day (n=61)		
Mean, s.e.	56 (4)	47 (4)		
Sex*	Male (n=67)	Female (n=40)		
Mean, s.e.	55 (3)	44 (6)		
Age**	18-20 (n=22)	21-35 (n=33)	36-55 (n=38)	>55 (n=11)
Mean, s.e.	64 (5)	53 (5)	45 (5)	44 (11)
Prior visits to Bitterroot canyons**	1 (n=34)	2-5 (n=17)	6-20 (n=24)	>20 (n=32)
Mean, s.e.	54 (4)	64 (7)	51 (6)	39 (6)

*Differences statistically significant at alpha = .10.
**Differences statistically significant at alpha =.05.

Discussion

We have summarized the study results in table 7 by reporting the alpha values for the tests conducted in the analysis. One can use the table to determine what visitor characteristics are associated with specific decisions and outcomes. We feel these results are striking because the generally modest relationships are counter to many of our expectations.

The variable most closely associated with attention to the bulletin board messages was travel method. The use of a general factorial model incorporating travel method and other independent variables shows that travel method is usually the only statistically significant variable. Hikers were much more likely to stop at the bulletin board and attend to the messages than horseback riders. This result is

Table 5—Mean minimum impact behavior knowledge score, in percent.

Travel method**	Hiker (n=135)	Horse rider (n=51)		
Mean, s.e.	40 (2)	21 (2)		
Type of Use**	Overnight (n=78)	Day (n=108)		
Mean, s.e.	39 (2)	32 (2)		
Sex**	Male (n=112)	Female (n=74)		
Mean, s.e.	38 (2)	31 (2)		
Age**	18-20 (n=31)	21-35 (n=59)	36-55 (n=78)	>55 (n=15)
Mean, s.e.	45 (3)	36 (3)	32 (3)	31 (6)
Self-assessed Knowledge Of Minimum Impact** Behavior	Not Very (n=21)	Somewhat (n=66)	Very (n=66)	Extremely (n=31)
Mean, s.e.	28 (4)	30 (3)	38 (3)	44 (4)
Self-assessed Experience With Wilderness Travel**	Not at All (n=10)	A Little (n=32)	Somewhat (n=89)	Very (n=54)
Mean, s.e.	25 (6)	35 (4)	35 (2)	39 (3)
Prior visits to Bitterroot Canyons*	1 (n=59)	2-5 (n=42)	6-20 (n=30)	>20 (n=52)
Mean, s.e.	41 (3)	33 (3)	34 (3)	32 (3)

*Differences statistically significant at alpha = .10.
**Differences statistically significant at alpha =.05.

Table 6—Gains in knowledge with exposure to increasing numbers of messages. Figures shown are slopes in regression equations. Numbers of messages ranged from 2-8.

Type of Use**	Overnight (n=86)	Day (n=129)		
Regression slope, s.e.	.01 (.02)	.07 (.01)		
Educational Attainment**	High School Or Less (n=53)	Some College (n=59)	College Graduate (n=54)	Post Graduate (n=46)
Slope, s.e.	.05 (.02)	.00 (.02)	.12 (.03)	.07 (.03)
Prior visits to Bitterroot canyons**	1 (n=63)	2-5 (n=38)	6-20 (n=52)	>20 (n=57)
Slope, s.e.	.02 (.03)	.01 (.03)	.06 (.02)	.09 (.03)

**Differences statistically significant at alpha =.05.

similar to those found by Cole (1998) and Petersen (1985), but we wonder why. Certainly, stopping a horse (and a pack string) is difficult, and it may be this factor more than experience, interest or beliefs about minimum impact behavior that affects attention to bulletin boards. Once horseback riders did stop, they tended to look at the messages with a propensity similar to hikers. However, they spent less time attending to the messages than hikers. A fundamental question, for both managers and scientists, therefore deals with finding and evaluating mechanisms to effectively communicate minimum impact behaviors to horse riders. Petersen (1985) showed that trailhead locations are not very good places for registration, perhaps because of the number of competing attributes or because of a desire to "get on the trail." Presentations at group organization meetings, fairs and workshops may be more effective venues for horse riders than bulletin boards.

People who report they have been frequently exposed to messages spent more time viewing the messages we presented on the bulletin board, a somewhat surprising result in light

Table 7—Summary statistics for analysis. Data shows level of significance for each tested relationship.

Visit characteristics	Stopped at bulletin board	Looked at messages	Per message attention	Comprehension	Knowledge	Gain in knowledge with exposure
Travel Method	.000	.47	.09	.00	.00	.66
Type of Use	.04	.38	.16	.06	.02	.01
Social-demographics						
Age	.10	.11	.06	.01	.01	.26
Sex	.39	.25	.65	.10	.03	.98
Education	.21	.12	.47	.22	.49	.01
Prior Knowledge or Exposure						
Self-Reported Knowledge	.18	.11	.20	.98	.01	.26
Prior Exposure	.14	.12	.02	.61	.56	.73
Wilderness Experience						
Visits to Bitterroot canyons	.40	.17	.01	.03	.01	.01
Experience with Wilderness Travel	.09	.04	.20	.72	.05	.98
Wilderness Visits per Year	.07	.05	.03	.14	.46	.17
Total Wilderness Visits	.18	.08	.01	.30	.22	.86
Number of Wildernesses Visited	.25	.08	.28	.31	.64	.73

of previous research. Perhaps such individuals perceive the usefulness of the messages and are seeking confirmation of previous knowledge or dissonance reduction. The negative relationship between experience and attention was counter to our expectations. Experienced individuals may feel that minimum impact behavior messages are of little use to their wilderness visit. The negative relationship between age and attention may be superfluous: Horseback riders tended to be older than hikers.

Comprehension was primarily associated with travel method and type of use (overnight or day use), but relationships with age, sex and previous local experience were also found. With the exception of type of use, none of these findings was expected, and several of our expectations were not supported. While comprehension was associated with time spent attending to messages, travel method (although not type of use) was still statistically associated with comprehension. These findings bring up the question of what variables underlie the travel method distinction and how useful they are in explaining these differences. The practical difficulties of stopping horses to read messages may explain the different propensity of horse riders and hikers to stop at the bulletin board, but this would not be relevant to comprehension for those who paid attention to the message.

Knowledge levels were associated with a variety of variables. However, only the higher scores of overnight users, more knowledgeable visitors and those with greater general wilderness experience were expected. The negative relationships with local experience (in the Bitterroot canyons), and the lack of relationship between education and prior exposure to minimum impact messages were unexpected. What both findings suggest is that the process of communicating minimum impact persuasive messages is more complex that one might expect. Relying on passive communication media, such as signs and brochures may be simply not adequate. Comprehension was strongly related to knowledge levels, but travel method and type of use were also important. This suggests that if people stop and attend to the bulletin board and spend the time needed to read the messages, increases in knowledge will result.

We did find that education had an important effect once message attention occurred: Individuals with higher levels of education appear to have a greater capacity to assimilate message content as the number of messages increase. Thus, if visitors do stop, and they are highly educated, they can process a number of messages. Managers can feel confident then that they are communicating effectively.

The results suggest that bulletin boards, at least the kind studied here, are effective only for hikers. However, even this group attended to each message hardly long enough to deliberate on its contents, meaning and application. The fact that only 64% of passing visitors stopped at the bulletin board suggests that the messages may not have been perceived as being useful. This conclusion is confirmed by Cole's (1998) study in which he found that appeals to read the messages, other than a simple request, had little or even negative effects on the proportion of visitors stopping. This altruistic motivation may outweigh more instrumental or utilitarian pleadings.

Slater (1997) also argues that "people read, listen to, and view messages because they choose to in order to achieve some purpose or end…" Essentially, the decision to stop is influenced by the perceived utility of the message to the wilderness visit. It is quite likely that information about minimum impact behaviors is not viewed as useful by wilderness visitors. Brown and others (1992) reported that only one respondent of 93 contacted in the Pemigewasset Wilderness in New Hampshire felt that "low-impact camping techniques" were helpful to their trip. This was far less than the 25.8% who felt information on location of campsites was helpful. It is not clear from this study or others (e.g., Cole 1998) how bulletin boards could be designed to be more useful for horse users or be more effective in relating minimum impact messages.

Finally, there are theoretical questions that confront scientists. For example, past research in a number of settings has suggested that messages that stimulate elaboration or deliberation more effectively engendered the desired behavior. Our study did not examine this question, but it would seem appropriate to ask when such elaboration

occurs, if it does, and its effectiveness. Certainly, the data shown here suggests that elaboration does not occur during or immediately following viewing of messages. Perhaps it occurs on the trail or at the campsite. However, Roser (1990) concluded that it takes time to integrate persuasive messages, even if they are accepted, into one's personal values and then act on them. Elaboration of message content may be one process for integration, but there may be others as well.

The concept of involvement can have great utility in explaining message elaboration processes. Petty and Cacioppo (1986) and numerous followers hypothesize that involvement increases the likelihood that message receivers will process message content, elaborate on it and choose to behave accordingly. Celsi and Olson (1988) report that message attention is positively correlated with involvement. In this sense, those with higher levels of wilderness experience or those most aware of human impacts on wilderness conditions might be more involved individuals, and thus more likely to attend to and process minimum impact behavior. Our data showed (both here and in Cole and others) that message attention (measured in time) was positively correlated with knowledge of minimum impact behavior, reinforcing this hypothesis. While involvement as a scientific construct has many meanings (Slater 1997), it would be useful to explore what involvement means in this context and to develop measures that can be tested. Our shadow measure of involvement (previous wilderness experience) was modestly successful in explaining some of the results.

Better understanding the conditions under which visitors attend to and process messages will help identify more effective persuasive message strategies, a search that has not only scientific relevance but utility for those working in resource constrained agencies. Slater (1997) suggests that "Recipients are active in choosing to be exposed to various messages and are purposive or goal-directed in seeking various instrumental utilities and personal gratification from such message exposure." By investigating the social and situational factors affecting this choice process, as well as the personal and instrumental benefits from the choice, scientists may be able to provide principles for increasing attention to minimum impact messages posted at trailhead or trailside bulletin boards.

Our study leaves open the need to design more effective persuasive communication channels for wilderness managers. Certainly, the data suggest that a variety of media are needed to reach intended audiences, hardly a startling conclusion, but one that is important in an era of scarce communication resources. Understanding the audience, how it chooses to attend to various messages and at what stage to measure effectiveness remain important questions for both managers and scientists.

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Information Collection Styles of Wilderness Users: A Market Segmentation Approach

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Abstract—Attempts to influence the behavior of wilderness visitors through the use of information are limited by the visitors' reception of that information. This study examined the information gathering behavior of wilderness visitors and the effect of different information collection styles on visitors' knowledge of low-impact behavior and attitudes toward wilderness management. Four distinct information collection styles were identified in a cluster analysis procedure. There were small, but statistically significant differences in knowledge of low-impact behavior between individuals using different information collection styles. There were no significant differences in attitudes toward wilderness management between individuals using different styles.

One of the primary assumptions of the wilderness experience is that it should be a relatively unregulated experience. Unfortunately, many types of behavior can damage wilderness recreation sites. Wilderness areas are difficult to patrol and many managers are averse to over-regulating the wilderness experience. Because of these factors, most attempts to influence the behavior of wilderness users involve information and education, but these attempts depend on the visitors' information collecting habits. More effective communication with visitors will be possible if managers understand where and how visitors collect information.

Previous research in this area has indicated that visitors may be more or less active in their pursuit of information (Manfredo and Bright 1991), may attend to that information in different ways (Vogt and Stewart 1998) and may adjust their search habits based on previous experience or their personal investment in the trip (Rogers and Ramthun 1998). There is a growing body of evidence that people plan recreational trips by searching for information selectively from a variety of sources using a variety of search strategies (Fodness and Murray 1999). The search strategy and information sources selected by the trip planner have the potential to affect visitor behavior and visitor attitude toward the site. Visitor education programs are designed to provide information to visitors that may persuade them to make behavioral changes, therefore it is important to measure the extent to which visitor education information is selected and relied on by visitors.

The "Leave No Trace" program (often referred to as LNT), is a joint educational effort by the USDA Forest Service, National Park Service, the National Outdoor Leadership School and other organizations to persuade outdoor travelers to engage in low-impact camping and travel behaviors.

Hypotheses

This study tested two hypotheses: (1) that wilderness visitors would display varying styles of information collection, and (2) that the style of information collection used by the visitors would affect their knowledge about appropriate wilderness behavior.

Methods

Survey Location

The Mt. Rogers National Recreation Area is a unit of the George Washington-Jefferson National Forest in southwestern Virginia. It is a 123,000-acre recreation site that contains three federally designated wilderness areas. The Mt. Rogers NRA is very popular with hikers and backpackers seeking scenic views from the "crest zone," which is distinctly different from most southern Appalachian mountains. The Appalachian Trail and the Virginia Highlands Horse Trail traverse the area. The Mt. Rogers wilderness areas are easily accessible, located relatively near roads and a popular state park.

Sampling Procedure

An on-site survey measuring respondents' knowledge of low-impact behaviors, attitudes toward wilderness and reliance on different information sources was administered to 197 wilderness visitors at Mt. Rogers NRA in Virginia. The surveys were administered between September 1995 and June 1996, at four trailheads providing access to the Mt. Rogers wilderness areas. Surveys were administered at times that were randomly selected by week and month. Surveys were given only to individuals who had passed a trailhead signboard, thereby guaranteeing they had at least one opportunity to see LNT information and local wilderness regulations. Several data collection periods were cancelled and rescheduled due to severe weather.

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Questionnaire Construction

The survey contained a nine-item "quiz" on Leave No Trace principles and local wilderness regulations. The quiz was developed in conjunction with the Mt. Rogers NRA personnel. Each item on the LNT quiz was given a score of "1" if the respondent provided a correct answer or "0" if the respondent provided an incorrect answer. The complete LNT quiz is included in table 1. In addition to the LNT quiz, there was a series of questions on visitors' attitudes toward wilderness and motives for visiting wilderness. These attitude and motivation questions were scored on a five-point Likert scale. The questionnaire also contained a 14-item list of potential information sources of information that might be used by individuals planning trips to Mt. Rogers or other wilderness areas. Respondents were asked to rate their use of these potential information sources on a five-point Likert scale, with "5" representing sources that were used often and "1" representing sources that were never used. The information use items are included in table 2. A hierarchical cluster analysis using SPSS, Version 8 was performed to identify discrete styles of information gathering. Relationships between information gathering style and knowledge of low-impact behavior and wilderness regulations were examined.

Table 1—The Leave No Trace quiz.

There are a large number of regulations that apply to people using the Mt. Rogers wilderness areas. There are also a number of actions that the Forest Service recommends in order to improve the quality of the experience for all users. We would like to find out how much you know about these regulations and recommendations. Please give your best answers to the following questions:

1. Your camp should be placed:
   (a) at least 20 feet from the trail.
   (b) at least 50 feet from the trail.
   (c) at least 100 feet from the trail.
   (d) at least 200 feet from the trail.

2. True or False—It is better to build fires than to carry a small stove into wilderness areas.

3. Any litter you create on your trip should be:
   (a) buried at least 10 inches deep.
   (b) hidden from obvious view.
   (c) packed out in a trash bag.
   (d) burned.

4. True or False—There are no restrictions on the number of people in your group while in the Mt. Rogers wilderness areas.

5. True or False—Remaining in the same campsite for more than four days may cause damage to plant life at that site.

6. If a campfire is built, it should be:
   (a) built with large branches cut from nearby trees.
   (b) in a meadow.
   (c) built in an existing fire circle.

7. True or False—Catholes or latrines for human waste should be placed about 100 feet from trails, campsites, or water sources.

8. True or False—Only the U.ºS. Congress can establish a wilderness area.

9. True or False—Mountain bikes may not be ridden in wilderness areas.

The questionnaire also contained a series of questions about respondents' assessments of crowding and trail use in the area. These questions were included at the request of area managers for later use in their LAC process.

Results

Sample Description

The sample represented 122 males and 75 females. The mean age of the respondents was 34.7 years, with a range from 17 to 63 years. The education level of the sample, consistent with other wilderness research, was quite high; 34% of the sample had completed a bachelor's degree, while 23% of the sample had attended graduate school. The overall income levels of the respondents were also quite high, with 30% reporting incomes over $60,000.

The sample represented a variety of activity groups: 46.7% of the respondents were day hiking when surveyed, 32% were backpacking, 10.2% camping and 6.6% hunting. Horseback riding, fishing, running, photography, viewing wildlife and other activities composed the activities of the remaining 5% of sample respondents. (Note: Horseback riding is underrepresented in this sample. Horseback riders consistently declined to participate in the survey, probably due to problems with controlling the animal or because they were members of large groups.)

Cluster Analysis

Cluster analysis indicated four distinct styles of information collection. Cluster One was composed of "inactive searchers" (Manfredo 1992). Individuals in this cluster reported below-mean reliance on all of the possible information sources, with the exception of *friends or family members*. Previous research has indicated that many backcountry travelers rely on more experienced members of their party as a primary information source (Ramthun 1998). Cluster One represented 32% of the survey respondents.

Cluster Two contained 29% of the sample respondents and was characterized by reliance on a limited range of potential information sources. These respondents reported above-mean reliance on *magazines about hiking and backpacking* and *literature provided by the Forest Service.* Individuals in this cluster were characterized as "selective searchers".

Cluster Three contained 19.5 % of the sampled respondents. Individuals in this cluster reported above-mean utilization of a wide variety of the potential information sources listed on the questionnaire. These individuals reported above-mean use on all of the written information sources with the exceptions of *Magazines about hunting and fishing* and *Magazines about horses and trailriding*. Individuals in this cluster were characterized as "readers".

Cluster Four contained 18.9 % of the sampled respondents. Respondents in this cluster reported above-mean reliance on their membership in hiking or riding clubs, scout groups and college outing programs, as well as above-mean reliance on trail signs and bulletin boards provided at the site. This pattern of use was difficult to characterize but it seemed to represent a "personal/on-site" pattern of information collection.

Table 2—Information source items.

People use a variety of information sources to learn about outdoor sports and to determine how and where to travel in the outdoors. Please read the following list of information sources and mark the degree to which you have used this source to learn about your sport or about travel in and to the Mt. Rogers wilderness areas.

	Never use	Use occasionally	Use frequently
Learned from friends or family members.	1	2.....3.....4	5
Magazines about horses and trailriding.	1	2.....3.....4	5
Magazines about hunting and fishing.	1	2.....3.....4	5
Magazines about hiking and backpacking.	1	2.....3.....4	5
Magazines from special groups such as the Sierra Club	1	2.....3.....4	5
Books written specifically about hiking, horseback riding, hunting or other sports.	1	2.....3.....4	5
Articles in local newspapers.	1	2.....3.....4	5
Sports shops or specialized stores.	1	2.....3.....4	5
Literature provided by the Forest Service.	1	2.....3.....4	5
Trail signs and bulletin boards provided by the Forest Service.	1	2.....3.....4	5
Membership in clubs for hiking, horseback riding, hunting, or other sports.	1	2.....3.....4	5
Membership in organized groups such as the Scouts.	1	2.....3.....4	5
Participation in college classes or outing groups.	1	2.....3.....4	5
Other_____.	1	2.....3.....4	5

Leave No Trace Knowledge

The respondents in this survey scored quite low in their knowledge of LNT principles and local wilderness regulations. The sample mean was 5.79 on the nine-point LNT quiz (modal score was 6). These finding are consistent with other on-site surveys, which found visitors had an intermediate level of knowledge of LNT practices (Confer and others 1998). Of the 182 surveys from which usable data could be obtained, only two respondents had perfect scores.

Analysis of Variance

Analysis of variance indicated that there was a statistically significant difference in knowledge of low-impact behavior between visitors who utilize different information collecting styles (table 3). The "readers" cluster mean score was 6.26 on the nine-point LNT quiz. The "inactive searchers" cluster mean score was 5.26 on the LNT quiz. This was the only statistically significant difference between clusters ($p = 0.0019$).

Table 3—Leave No Trace mean scores by cluster.

Cluster	LNT mean
Cluster 1—"inactive searchers"	5.26*
Cluster 2—"selective"	5.96
Cluster 3—"readers"	6.26*
Cluster 4—"personal/on-site"	5.93

*Denotes groups significantly different at the 0.05 level.

Two additional analysis of variance procedures were done to examine the relationship between information collection styles and attitudes toward the wilderness resource and its management. The items in this portion of the questionnaire asked respondents to rate the value of wilderness to their activity, their level of support for more areas to be managed like the Mt. Rogers NRA and their potential willingness to support a permit system if that became necessary to control crowding and overuse. There were no statistically significant relationships between information collection styles and any of these attitudinal measures. The information collection style of visitors does not have any impact on their attitudes about the value of wilderness or attitudes about the implementation of permit systems.

Conclusions

The results of the study support Hypothesis 1: There are distinct and measurable differences in the patterns of sources that outdoor recreationists use to gather information. The results also support Hypothesis 2: Information collecting style does have an effect on knowledge of low-impact behavior. The additional assumption that information collection style may influence attitudes toward the resource or its management was not supported by the evidence. Most of the respondents placed consistently high value on the Mt. Rogers wilderness areas and were supportive of most management policies. This comparative lack of variance in response was probably responsible for the finding of no statistically significant relationships between information collection style and attitudes.

Implications

The visitors to the Mt. Rogers wilderness areas who were sampled in this study had a relatively low knowledge of LNT practices and wilderness area regulations. The sample mean of 5.79 on a nine-point quiz is the equivalent of a "D" on the test. All the information tested by the quiz was located on trailhead signboards that the respondents passed at least once and, in many cases twice or more, indicating that many wilderness area trail users pay little attention to signs. Visitors who rely primarily on written sources of information have a better understanding of low-impact behaviors recommended by the managing agency, but these "readers" only made up 20% of the sample. Many visitors rely heavily on less formal sources on information, such as sport shops, activity clubs or experience with organizations such as the Scouts. By dispersing wilderness information through a wider variety of media, including clubs and organizations, managing agencies can make information available to a wider range of visitors.

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Preparing for a Day Hike at Grand Canyon: What Information Is Useful?

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Abstract—Most parks are interested in conveying hiking safety and minimum impact techniques to visitors. At Grand Canyon National Park, providing such information to more than 2000 day use hikers per day has been a longstanding concern whose effort has increased in intensity over the past decade. This study evaluates aspects of the "Heat kills, hike smart" campaign that targeted day use hikers during summer, 1997. The park's information campaign was able to reach most day use hikers, and affected the behavior of the majority of them. Among various media sources and locations used by the park to convey safety information to day use hikers, the two most effective sources were the Park Guide distributed upon entering the park (in newspaper-style) with its banner headline claiming "Heat kills, hike smart" and posters at each trailhead with the same "heat kills" information. Day use hikers of remote backcountry trails reported the highest probability for problematic behavior (e.g., no water, became sick or injured). Minimum impact information concerning the proper disposal of toilet paper and food scraps was widely unknown.

Day use hiking in parks, wilderness and related areas is an emerging issue that warrants research and management attention. Although monitoring of day use is often sketchy and difficult to interpret, it is apparent that day use accounts for the majority of visitation in many, perhaps most, park and related areas. For example, the National Park Service reported a total of nearly 279 million visits in 1995. However, only 14 million visits were reported as overnight stays (National Park Service, 1996).

Even in the backcountry and wilderness portions of parks, which are commonly associated with overnight use, day use hiking accounts for a large percentage of total use, even a majority of use, in many areas. This is true across all four of the major federal land management agencies. Day visits, for example, are the most common length of stay in many small to medium size U.S. Forest Service wilderness areas (Roggenbuck and Lucas, 1987). Even in some large U.S. Forest Service wilderness areas, such as the Spanish Peaks and Selway-Bitterroot Wilderness Areas, day use accounts for about half of all visitors (Lucas, 1980). A recent study of backcountry areas in the national park system estimates that day use comprises 64% of total use (Marion and others, 1993; Manning and others, 1996). Earlier research estimated that day use represents 44% and 83% of all use on Bureau of Land Management and U.S. Fish and Wildlife Service wilderness areas, respectively (Washburne and Cole, 1983). In short, day use hiking is one of the most popular activities in backcountry areas and often receives inadequate managerial and research-based attention (Roggenbuck and others, 1994).

Day Use Hiking at Grand Canyon

Compared to studies of other recreational uses at Grand Canyon, research on day use hikers has been scarce. There are general impressions that day use hiking is increasing throughout the Park, including many of the its backcountry trails. In recent years, Grand Canyon's search and rescue (SAR) efforts and expenditures have increased dramatically, with most of these efforts involving day users who were not prepared for their hike. The trails and trailheads of the Park have become more accessible in recent years, and a proposed visitor orientation center along with a comprehensive transportation shuttle system, has the potential to control the times and places where visitors travel. Thus, Park staff is in need of basic information about day hikers. This paper presents results about the information visitors used to prepare for a safe day hike, and represents a portion of a larger project directed at understanding other aspects of day use hiking at Grand Canyon National Park (Manning and others, 1999).

Hiking at Grand Canyon has some unusual characteristics. At many other parks, minimum impact hiking is a more serious concern than hiking preparedness and safety. However due to extreme summer heat in the bottom of the canyon, lack of shade and water on most trails, and the steep

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uphill climb, which comes after the seemingly easy descent, many day hikers at Grand Canyon have had serious problems completing their hike. For most of their summer season, Park rangers find themselves focused on the safety of day hikers. During summer of 1997, the Park implemented a widespread information campaign to alert visitors to the dangers of day hiking. The "heat kills, hike smart" campaign alerted hikers to the importance of drinking water and eating food to replace electrolytes, avoiding the heat of the day, and knowing one's limits about hiking beyond one's ability. This study evaluated the campaign and, in doing so, provided insight to the frequency of problematic behavior among day hikers, information sources accessed for hiking preparation, what was learned from these sources and its effects on hiking behavior.

There are three kinds of trails at Grand Canyon which served to stratify the design and results of this study. The *rim trails* are well-developed, attract more than 1000 visitors on an average summer day and follow the rim of Grand Canyon, passing through most overlooks and other "front country" attraction sites. On the south rim, most of these trails are paved, and some provide access to water and restrooms. The *corridor trails* are also well-developed (though not paved) and wind their way down to the bottom of the canyon. The Bright Angel Trail is the most heavily used of the corridor trails, receiving more than 1200 day use hikers on an average summer day, and hikers have access to water, restrooms, Park rangers and other amenities such as campgrounds and interpretive signs. The *threshold trails* are poorly maintained trails going into the canyon, with comparatively remote trailhead access and lacking water and other amenities; during the course of this study, threshold trails received less than 20 day use hikers per day.

Methods

To survey a representative sample of day use hikers of the rim, corridor and threshold trails at Grand Canyon, an on-site interview, coupled with a mail-back questionnaire, was selected as the study technique. The on-site interview contained a series of questions related to hiking preparedness and safety. The follow-up mail-back questionnaire contained general items regarding descriptive information about respondents' day hike, their attitudes about minimum impact recreation and their knowledge of day hiking etiquette and rules, among several other topics not related to preparation for a day hike. A sampling plan was designed that stationed an interviewer at selected trails during the summer and fall of 1997. Of the day hikers selected to participate (in a systematic random fashion), more than 95% complied with the interview. There were 361 completed interviews with rim day hikers, 379 interviews with corridor day hikers and 118 interviews with threshold day hikers. All respondents were given a mail-back questionnaire to complete. Respondents with a U.S. residence were sent a postcard reminder and a second questionnaire if the original questionnaire had not been returned within three weeks. The response rate for the mail-back questionnaire was 48%.

Results

Hiking Preparedness

A primary objective of the Park's 1997 hiking preparedness information campaign was to change visitor behavior to promote safety. Questions were developed to evaluate the effectiveness of the hiking preparedness campaign and were organized in the following sequence: (1) Respondent identified the information used to prepare for a safe hike, (2) reported the location of information source, (3) specified what was learned from the information source, and (4) noted what behavior was changed due to learned information.

What Information Sources Were Used?—The first question asked respondents to identify the primary sources of information that helped them prepare for a safe day hike; respondents could indicate all sources used. In general, summer hikers were more likely to use information sources than fall hikers. Across both summer and fall, the most common information source used was the Park Guide, which is a newspaper-style brochure distributed to visitors as they enter the Park. During the summer months, the headlines on the Park Guide read "Heat Kills, Hike Smart" and depict a schematic pictorial of a tired hiker sweating from an apparently exhaustive hike. The traditional front page of the Park Guide features a scenic vista of Grand Canyon and portrays the beauty of the Park. In short, during 1997, the Park staff put hiking safety information up-front where all visitors would be exposed to it.

Over 90% of summer respondents on the corridor, threshold and rim trails reported using the Park Guide; at least 40% of fall respondents on the corridor, threshold and rim trails reported using it. The poster on hiking safety was the second most popular source of information. These posters were visible at many places throughout the Park and surrounding motels and restaurants. During the summer, 91% of corridor and 82% of threshold respondents reported using the poster to prepare for a safe day hike; during the fall, 49% of corridor and 34% of threshold respondents reported using the poster.

The message about "heat kills," which was contained in many brochures and post-its, also was popular during the summer months, with more than one-third of respondents on the corridor, threshold and rim trails reporting that they used this message as an information source. Respondents who hiked on the corridor trails in the summer were almost twice as likely to report using a Park ranger as an information source, compared to hikers of other trails and/or season; 33% of summer corridor respondents reported that a Park ranger was a helpful source of information, compared to 18% of fall corridor respondents; summer threshold respondents were the least likely to use a Park ranger, with 14% reporting use of one.

During the summer of 1997, stop signs were placed on trails at strategic locations, warning hikers not to proceed beyond the sign. These stop signs contained explicit information on problems with heat exhaustion and other maladies. Hikers of the summer corridor trails were most likely

to report the stop signs as an information source, with 36% of such respondents reporting use of stop signs on trails; next highest were the summer threshold respondents, with 18% reporting use of the signs.

There were three sources of information reported that were not directly administered by the National Park Service (NPS). Use of "guidebook, magazine or newspaper" was reported by a plurality of day hikers; about 45% of fall threshold and summer rim respondents indicated use of such sources. "Friends or relatives" were reported as a useful source and ranged from 12% of fall corridor to 3% of summer corridor respondents reporting use of friends or relatives. "Employees from store or lodge" were the least likely to be reported as a source of information, with less than 1% of summer respondents on the corridor, threshold and rim trails reporting use of this source.

Where Did They Find Information Sources?—Along with the sources of information that they used, respondents were asked the location of information sources for each source reported. For the Park Guide, the majority of respondents reported receiving it at the entrance station. For example, 70% of summer corridor respondents reported the NPS entrance station as the source of the Park Guide. The Visitor Center as a source was a distant second place; 17% of summer corridor respondents reported the Visitor Center as the source of the Park Guide.

About two-thirds of respondents on corridor and threshold trails reported the trailhead as the location of the poster on hiking safety. Rim trail respondents were split between two locations: the trailhead and visitor center. Thirty-seven percent of summer rim respondents reported the trailhead as the poster's location, and 31% reported the Visitor Center.

Messages about "heat kills" were reported in a variety of locations, with the three most popular being the Visitor Center, hotel or restaurant and the trailhead. Other locations where respondents reported seeing this message include miscellaneous places inside and outside the Park, at the Backcountry Office and at the NPS entrance station.

Learning about hiking preparedness from Park rangers took place in a variety of locations. Fifty-six percent of summer corridor respondents reported the location as being on the trail. Of fall corridor and threshold respondents, 89% and 55%, respectively, reported the Visitor Center as the location. Other places where Park rangers were reported as an information source include Backcountry Office, hotel and restaurant, miscellaneous places inside the Park and guided programs.

What Was Learned From Information Sources?—Respondents were asked to identify the information they learned from each source. As a general finding, there were several things learned from each information source, there was not any information exclusively related to one source, and almost everyone learned something. The most common information learned to prepare for a safe day hike included: need adequate drinking water, need food and electrolyte replacement, need to know one's limits and be prepared to rest, avoid the heat of midday, appropriate equipment, and trail conditions and lengths.

Summer threshold respondents were more likely to learn about the need for adequate drinking water and food/electrolyte replacement from the overnight backcountry use brochure (called the Trip Planner) compared to other sources; they also were likely to learn about avoiding the heat of midday from stop signs on trails, compared to other sources. Both summer and fall threshold respondents were most likely to learn about altitude problems and weather/lightning from the Trip Planner, compared to other sources. Across most trails and seasons, respondents were likely to learn about trail conditions, lengths and the precaution about hiking to river and back in one day from a Park ranger, with the Park Guide being the second likely source for this information.

Was Behavior Affected by Information?—The information learned was effective in changing the *timing of the hike* for at least one-third of threshold and corridor respondents. Specifically, 35% of summer and 43% of fall threshold respondents changed the timing of their hike due to information they learned; and 55% of summer and 47% of fall corridor respondents reported changing the timing of their hike. The most typical change was to start the hike earlier or later to avoid the midday heat.

The information learned also was effective in changing the *length of the hike* for about two-thirds of summer threshold and corridor respondents. Specifically, 68% of summer threshold and 64% of summer corridor respondents changed the length of their hike due to information learned; and 44% of fall threshold and 56% of fall corridor respondents changed the length of their hike. The most typical change was to shorten the distance hiked.

The information learned also was effective in changing what respondents *brought with them on the hike,* as more than one-half of summer respondents reported such. The change in behavior most often reported was bringing more water. Specifically, about 63% of summer threshold and 69% of summer corridor respondents brought more water due to information they learned; and 33% of fall threshold and 48% of fall corridor respondents brought more water. The second most reported change in behavior was bringing food and electrolyte replacement on the hike. About 42% of summer threshold and 34% of summer corridor respondents brought food due to information they learned.

Problematic Behavior

The mail-back questionnaire contained a set of questions that asked about the amount of time spent day hiking. Respondents were asked "Did you spend more time (or less time) than you expected on your day hike?" About one-half of respondents who hiked the corridor in the summer reported hiking about what they expected; 37% reported less time than expected, and 12% reported more time than expected. Respondents who hiked the rim or primitive trails in the summer were the two groups with the largest proportion *reporting more time compared to less time* spent day hiking; compare 28% to 14% for respondents who hiked the rim trails in the summer, and 22% to 8% for respondents who hiked the primitive trails. The amount of time reported as more or less than expected averaged more than an hour across both seasons and all locations. Summer respondents were most likely to report trail conditions as the reason that

the length of their hike was different than expected, whereas fall respondents were most likely to report that fatigue, injury or physical fitness conditions affected their hiking time.

Another item on the mail-back questionnaire asked respondents if anyone in their group became sick, injured or lost on their day hike. The summer threshold and rim respondents were the most likely to report sickness, injury and/or being lost: 20% of summer threshold respondents reported that someone in their group became sick on their day hike, 10% of summer rim respondents reported this, as did 6% of respondents who hiked the corridor in the summer. In this sense, the *problem trails, where day hikers more often became sick, injured or lost in the summer, are the threshold and rim trails*.

As part of the on-site questionnaire, respondents also were asked "How much water (and/or fluids) did you and the rest of your group carry today?" On average, summer corridor respondents carried the most water per person at 4.9 quarts/person. On average, summer threshold respondents carried about half the water of their corridor counterparts; 2.6 quarts/person was the average water carried. As a consequence, summer corridor hikers were the least likely to report that they did not bring enough water. In fact, *respondents who hiked the threshold trails in the summer were more than twice as likely to report that they did not bring enough water,* compare 5% and 2%, respectively.

Respondents also were asked about the supplies and equipment that "you or someone in your group brought with you on your hike today." Of respondents who hiked the corridor trails in the summer, 97% of the groups interviewed brought water with them, 27% brought electrolyte replacement, 79% brought food, 10% brought a map, and 25% brought toilet paper. Of respondents who hiked the threshold trails in the summer, 88% of the groups interviewed brought water, 19% brought electrolyte replacement, 68% brought food, 39% brought a map, and 37% brought toilet paper. Of respondents who hiked the rim trails in the summer, 69% of the groups interviewed brought water, 17% brought electrolyte replacement, 46% brought food, 68% brought a map, and 17% brought toilet paper. Threshold respondents were the most likely to bring along toilet paper and a trail map, and they appeared to be aware of trail amenities and had given thought to supplies they need on their day hike; yet *it is a concern that threshold respondents were less likely to bring water than their corridor counterparts*.

Two items on the mail-back questionnaire asked respondents about their level of physical fitness. The first question asked "How physically fit (for hiking) do your consider yourself to be?" Most respondents indicated being at least "somewhat fit." The group with the lowest average self-reported fitness were the respondents who hiked the rim trails in the summer; respondents who hiked the primitive trails, averaged the highest fitness response. The second question asked respondents to report "how frequently do you get at least 20 minutes of physical exercise?" Again respondents who hiked the rim trails in the summer reported the least amount of exercise and respondents who hiked the primitive trails reported the most.

As part of the on-site interview, respondents also were asked the following open-ended question: "Is there anything else the National Park Service could have done to make you more prepared for a safe day hike at Grand Canyon?" About two-thirds of respondents answered this question. The most common response, across both seasons and all locations, indicated that the NPS could provide more information about Grand Canyon trails, with several asking for a trail rating system. (Although the Park Guide contained a trail rating system, it was not highlighted on the front page and may have been missed by some visitors.)

Attitudes and Knowledge About Minimum Impact Hiking

The mail-back questionnaire contained a set of items that assessed day hiker attitudes about minimum impact issues. Their responses indicate that day hikers are clearly concerned about minimizing their individual impact on Grand Canyon and would like further information about low-impact hiking. In addition, respondents were asked for their agreement level on "if an accident happens to me on a Grand Canyon day hike, park rangers will be able to help me back to safety." Respondents who hiked the primitive trails were most likely to agree with this statement, and respondents who hiked the corridor trails in the summer were most likely to disagree.

Respondents to the mail-back questionnaire indicated their knowledge of appropriate low-impact behavior by completing a set of true/false items. There were four items that respondents had difficulty with—they concerned toilet paper disposal, recommended quantity of water, temperature differential between rim and river, and food scrap disposal. Each is discussed in turn. Respondents were most likely to lack knowledge about disposing of toilet paper. Their lack of knowledge was indicated in response to the following statement "When disposing of human wastes in places where toilets are not available, park rangers recommend that visitors bury their toilet paper." The statement is false; toilet paper, like other things, should be packed out. Corridor respondents were most likely to think this statement was true; 61% of summer corridor and 71% of fall corridor believed it was true. Half of the respondents of the threshold believed this statement was true, and half believed it was false.

In response to the statement "when hiking the Grand Canyon in warm weather, park rangers recommend that visitors take one quart of water per day," 26% of respondents who hiked the corridor trails in the summer believed the incorrect response of "true," as did 17% of respondents who hiked the threshold trails in the summer. Respondents who hiked the rim trails in the summer were the least knowledgeable, with 32% who indicated this statement was true. Park rangers recommend that visitors take four quarts of water per day per person.

In response to the statement "the air temperature at the bottom of Grand Canyon is usually about 5 degrees warmer than the air temperature at the rim," 38% of respondents who hiked the corridor trails in the summer indicated the incorrect response of "true," as did 31% of respondents who hiked the threshold trails in the summer. Forty percent of summer rim respondents indicated "true." The temperature differential between the rim and the river is usually a minimum of 15 degrees.

In response to the item "food scraps should be scattered widely to avoid concentrating wild animals," corridor and

rim hikers were the least knowledgeable. Of respondents who hiked the corridor trails in the summer, 14% reported the incorrect answer of "true," and 15% of summer rim respondents answered "true." Like toilet paper, food scraps should be packed out.

Conclusion

The information campaign at Grand Canyon affected the behavior of the majority of day use hikers during 1997. Among various media sources and locations used in the Park's information campaign, clearly the two most effective sources and locations were the *Park Guide distributed upon entering the Park, with its banner headline* claiming "Heat Kills, Hike Smart," and the *posters at each trailhead* with the same "Heat Kills" information. The segment of day use hikers with the *highest likelihood* of **not** bringing adequate water and of becoming sick, injured or lost are those on threshold trails. However, even though day use hikers on corridor trails have the *lowest likelihood* of problematic behavior, the absolute number of problematic day use hikers is still highest on corridor trails. In other words, 20% of 20 threshold hikers per day (that is, four 4 people) is less than 2% of 1,200 corridor hikers per day (24 people). Thus, even though threshold hikers are more at-risk for problematic behavior, management efforts should maintain their concentration on corridor trails. To change the managerial setting of threshold trails would effectively change the context of the threshold day hiking experience and, in doing so, could make less distinction between the threshold and corridor trails as day hiking opportunities. Along with continuation of information aimed at hiking safety, minimum impact information on specific topics needs more visibility, particularly with corridor day hikers (who were the least knowledgeable segment).

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4. Visitor Management

Monitoring Social Indicators in the Bear Trap Canyon Wilderness 1988–1998

Joe L. Ashor

Abstract—Since its inception as a wilderness planning and management tool almost 15 years ago, the Limits of Acceptable Change (LAC) process has stressed the importance of monitoring. Monitoring social conditions is critical to ensure that quality visitor experiences are maintained. Ten years of data collected from monitoring three river corridor-related social indicators in the Bear Trap Canyon Wilderness in Southwestern Montana are analyzed. Results indicate there is very little direct relationship between use levels of floaters and hikers and the ability to meet the LAC social standards. The data also showed that the standards for most of the indicators monitored, are not being met on weekends.

The Bear Trap Canyon was designated wilderness on October 31, 1983 as one of four units of the Lee Metcalf Wilderness. Located in Southwestern Montana, it was the first Bureau of Land Management (BLM) area to enter the National Wilderness Preservation System. It is only 6,000 acres in size, but contains almost nine miles of the Madison River within its borders. In 1984, a management plan was written for the area that directed the BLM to establish environmental and social management standards through the use of the Limits of Acceptable Change (LAC) process. In 1991, LAC management direction was completed, using two resource indicators and four social indicators. Standards were established for each indicator, using a planning team comprised of wilderness users, river outfitters, landowners and BLM wilderness staff personnel. The wilderness was also zoned into three classes, ranging from "class I (most pristine)" to "class III (least pristine)." The river corridor was divided into two separate classes: II and III. The three indicators and standards analyzed in this study included the following:

Indicator	Standard
1. # of encounters per day between float groups and other float groups	80% chance of encountering no more than 3 other float groups
2. # of encounters per day between float groups and groups on shore	80% chance of encountering no more than 1 other shore group (Class II)
3. # of encounters per day between float groups and groups on shore	80% chance of encountering no more than 5 shore groups (class III)

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Data Collection

As the literature on the LAC process has pointed out numerous times, monitoring is essential to determining what types of changes in social and biophysical conditions may be emerging over time; and it is critical in determining the effectiveness of management actions in addressing impacts and concerns. Monitoring provides information vital to management because it may suggest needs for revisions in actions or acceptable conditions (McCool and Cole 1997.) Monitoring in the wilderness was conducted by a BLM river ranger and the two commercial river outfitters permitted to operate on the river. Wilderness visitor contact record forms were used in the field to keep track of the number of groups encountered. The number of patrol trips per year varied from 37 to 81 and averaged 63 per year over a 10 year time span, 1989-1998. During this time, both use levels on the river and on the shore were also monitored with a combination of visitor registration stations and electronic traffic counters. Ten years of data were analyzed, with particular attention paid to the relationship between use levels and the condition of the various standards. Other factors that may have had an effect on this relationship were also explored, such as water levels of the Madison and other nearby rivers.

Findings: The Condition of the LAC Indicators and Standards

Figures 1 and 2 show annual estimated visitor use levels in the Bear Trap Canyon Wilderness between 1988 and 1997. In general, use levels for both floaters and shore users almost doubled during this time period. Figures 3, 4 and 5

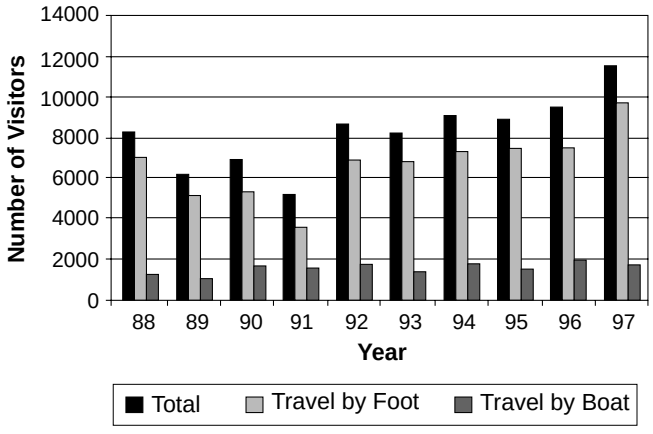

Figure 1—Bear Trap Canyon Wilderness visitor use 1988-1997.

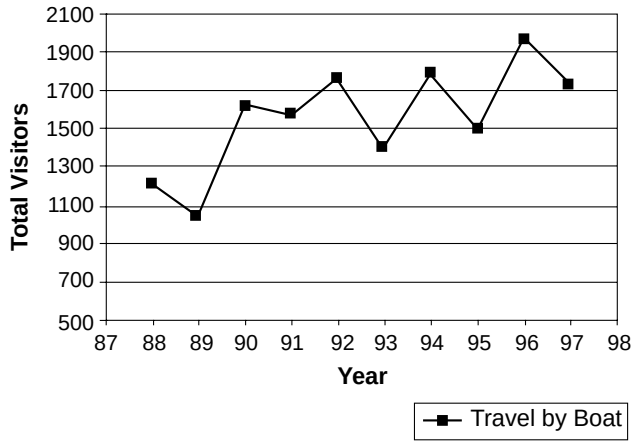

Figure 2—Floater use in Bear Trap Canyon Wilderness 1988-1997.

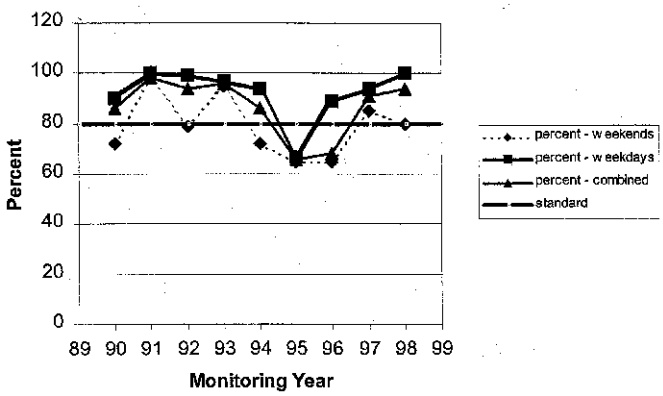

Figure 4—Indicator: Number of shore parties encountered while floating/day. Standard: 80% chance of seeing no more than 1 shore group (Class II).

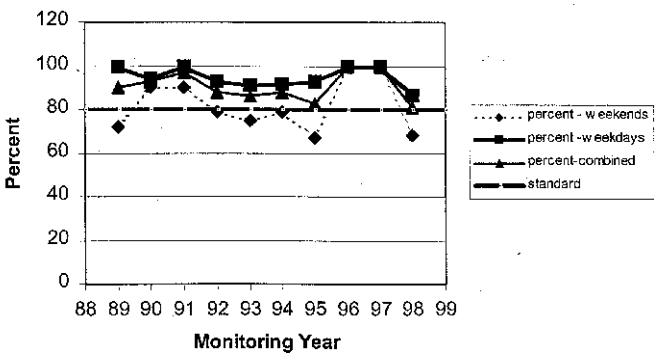

Figure 3—Indicator: Number of other float parties encountered while floating/day. Standard: 80% chance of seeing no more than 3 other float groups.

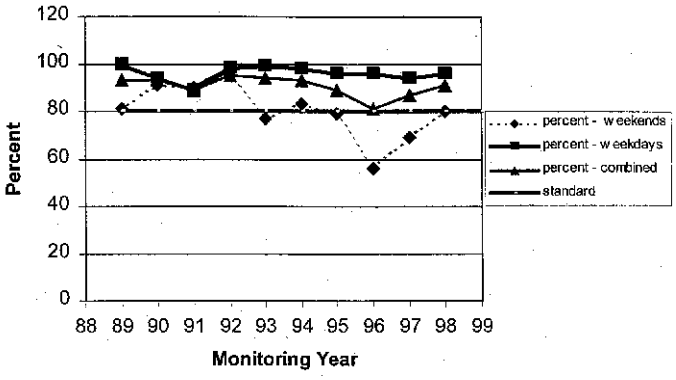

Figure 5—Indicator: Number of shore parties encountered while floating per day. Standard: 80% chance of seeing no more than 5 shore groups per day (Class III).

summarize the condition of three indicators monitored roughly during this same time (1989-1998). The standard is displayed at the 80 percent level. The dark bold line represents the LAC standard itself. Points above the line indicate acceptable social conditions for that particular indicator. Points below the line indicate that for that particular year, the standard was violated at varying degrees below the 80 percent level. For example, in figure 3, for the year 1998, the standard was only met on weekends at the 68 percent level, 12 percentage points below the LAC standard of 80 percent.

For Indicator #1—Number of encounters per day between float groups and other float groups, the following trends were observed (fig. 3). For six out of the 10 years, the standard of "80 percent chance of seeing no more than three other float groups per day," was not met on weekends. One would assume that during the years when the standard was not met, use levels should have been higher. That is, there should be a direct relationship between use levels and the condition of the standard. What the data show instead is a very weak relationship between floater use levels and the condition of the LAC standard. In years where the data show a large increase in floater levels, such as 1989 to 1990 and 1995 to 1996, the condition of the standard improved and in fact was met at the 100 percent level for weekends as well as weekdays for two years in a row (1996 and 1997).

For Indicator #2—For number of encounters per day between float groups and groups on shore (class II) the following trends were observed (fig. 4). In five out of the 10 years, the standard was not met on weekends; for one year, 1995, the standard was not met at all for both weekends and weekdays. Unlike indicator #1, the data show that there is more of a direct relationship between use levels on shore and the condition of the LAC standard. For example, between 1991 and 1992, the number of shore visitors almost doubled. The condition of the LAC standard showed a commensurate downward trend.

For Indicator #3—For number of encounters per day between float groups and groups on shore (class III), the following trends were observed (fig. 5). In four out of the 10 years, the standard was not met on weekends. The relationship between use levels and the condition of the LAC standard was also very similar to indicator #1. That is, even when use levels almost doubled between the years 1991 and 1992, the condition of the LAC standard still improved.

Observations of Influencing Factors

Based on the above data, the following observations were made. The relationship between use levels and the ability to meet the LAC standard is very complex and affected by a multitude of factors most of which are beyond the control of managers. Keeping in mind the fact that no new management actions were employed during the time period of the monitoring, what influencing factors might be involved in affecting whether or not the above three standards are maintained within the limit of acceptable change?

One factor has to do with the annual fluctuations in levels of both the Madison and other nearby rivers. When there is a low water year on other nearby rivers, making them unfloatable, floaters can still use the Bear Trap Canyon because of regulated minimum-flow standards. This tends to increase the crowding on the river in the Bear Trap Canyon. Discussions with both the two river outfitters and the BLM river ranger shed some light on why the conditions of the LAC standards improve even in years where crowding on weekends is a problem. The two river outfitters, who are aware of the LAC standards, are taking more weekday trips to avoid the crowding on the weekends and are also spreading their trips out over a longer season.

Changing overall use patterns also seems to be a contributing factor. More private boating parties are launching during the early evening hours, thereby avoiding encounters with other daytime float groups and shore groups.

Management Implications

What the data suggest is that when crowding on the weekends becomes a problem, wilderness visitors may alter what time they make use of the wilderness in order to maintain a quality experience for themselves or, in the case of the outfitters, their clients. The data also suggest that factors other than direct implementation of management actions by the BLM led to improved social conditions in the wilderness. Fluctuating annual water flows, changing user behavior, changing use patterns and other unknown factors all influenced whether the condition of the LAC indicators was maintained within standards.

This is not to suggest that managers should leave the quality of the social environment in the wilderness up to the visitors themselves. What was clearly lacking in this case was a response by managers to implement agreed-upon management actions to maintain the condition of all indicators within LAC standards. In general, indicators and standards are meant to be used as early warning devices to alert managers to unacceptable social and biophysical conditions in the wilderness. At the same time, standards are absolute limits - not just warnings. Violation of standards should not be tolerated (Cole and Stankey 1997). Managers have a responsibility, when the monitoring data show a clear downward trend, to implement management actions that will ensure that conditions remain better than the standards.

Conclusions

Ten years of monitoring social indicators in the Bear Trap Canyon Wilderness has revealed some unexpected relationships and trends. In general, the relationship between use levels and the ability to maintain standards within acceptable conditions is very complex and influenced by a variety of factors. One cannot assume that just because use levels significantly rise during a particular year, the condition of the LAC indicator will always decline. The data have clearly shown this is not always the case. Having a better understanding of the factors that influence the condition of a particular indicator would help managers determine the best course of action to take to assure standards are not violated.

A better protocol for monitoring indicators and standards in the Bear Trap Canyon Wilderness is also needed. Minimal procedures were initially established when the Bear Trap Canyon Wilderness LAC plan was completed almost nine years ago. There is a clear need to develop more effective monitoring procedures to help improve the accuracy and precision of the data.

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Standards of Quality for River Use Within the Fort Niobrara Wilderness Area

John B. Davis
Mark Lindvall

Abstract—The visual survey methodology of Manning and others (1996) was used to measure visitor response to the number of other floaters encountered on the Niobrara River within the Fort Niobrara Wilderness in Nebraska. An optical scanner and photo-editing software were used to produce 12 composite photographs of the Niobrara River, depicting a range of visitor use levels. In a survey administered to 235 visitors in June and July 1998, respondents were asked to rate the acceptability of each photograph, first from the viewpoint of a recreational experience and second from the standpoint of a wilderness experience. Analysis of the data suggests two standards of quality. The maximum acceptable level of crowding during peak demand periods is equivalent to eight persons launching per minute, and the level of crowding at which visitor satisfaction begins to decline is equivalent to three persons launching per minute.

Managers of the Fort Niobrara Wilderness are concerned that increasing levels of recreational river use within the wilderness will deny visitors an opportunity for solitude in the context of the 1964 Wilderness Act. Approximately 5.1 miles of the Niobrara National Scenic River lie within the Fort Niobrara Wilderness, located in the Fort Niobrara National Wildlife Refuge in northcentral Nebraska. Since 1961, documented use of the river for float trips has increased from several hundred people per year to more than 30,000 in 1997 (U.S. Fish and Wildlife Service 1999). Most of that use occurs on summer weekends, particularly Saturdays. Local commercial outfitters have a strong economic stake in continued expansion of river recreation since they provide approximately 95% of the vessels, equipment and a variety of associated services for floaters using the Niobrara River in the wilderness area.

There is currently no limit on the number of vessels or the size of parties that may float the river. However, all vessels are required to display a daily or annual permit to float the Niobrara River within the Fort Niobrara National Wildlife Refuge. A fee is collected for the float permits. Also, each outfitter operating on the refuge is issued a special-use permit. The managers of the refuge have capped the number of permitted outfitters at 11, pending the completion of a river recreation management plan.

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Indicators of Quality

The term *social carrying capacity* is used to refer to the maximum level of public use that still preserves the quality of an outdoor experience for visitors (Graefe and others 1984). The process of identifying a numerical value for carrying capacity can be thought of in four steps.

1) Identify a quantifiable measure for the visitor experience. This measure is frequently referred to as an *indicator of quality*.

2) Determine a numerical relationship between the indicator of quality and the visitor experience, over a range of values of the indicator. This can be accomplished with a survey administered to a sample of users of the outdoor recreation site.

3) From the results of the survey, define specific numerical *standards of quality* for the chosen indicator. The standards are an indication of the social carrying capacity.

4) Finally, compare actual use levels to the standards of quality and carry out management actions to bring use levels into alignment with the standards.

Manning and others (1996) have demonstrated that visitor response to perceived crowding at an outdoor recreation site can be expressed as a numerical standard of quality. For the Niobrara River, the number of floaters that a visitor will see on the river at any one time is an obvious choice for an indicator of quality. It can be easily expressed as a numerical quantity, it can be investigated over a wide range of values, and it is directly related to perceptions of crowding. However, direct counts of the number of visitors floating the river reveal that perceptions of crowding may result from clustering or "clumping" of vessels. Because outfitters bring parties to the launch site in buses, several large groups often launch simultaneously and may remain clustered together as they float down the river. The situation is further complicated by the fact that canoes move more quickly than tubes, so that a person in a canoe may pass through several clusters of tubes on a single trip. Therefore, a better indicator of quality is the number of persons launching per minute, or launch rate.

The launch rate at the Fort Niobrara Canoe Launch varies significantly depending on the day of the week and the season. The average level of use on summer Saturdays and holidays is equivalent to approximately five persons launching per minute. For reference, five persons per minute is roughly equivalent to two canoes and one tube per minute, or one canoe and three tubes. Rates several times higher

than average occur frequently on typical summer Saturdays as a result of the clumping of vessels.

In contrast, the average level of use on Sundays and weekdays in the summer and on all days during the remainder of the year is less than one person launching per minute. The difference between rates for summer Saturdays and other days is largely due to the location of the Niobrara River in relation to large population centers. It is a very attractive weekend destination, but one that is more difficult for a day trip. To reflect the difference in use patterns, we have defined two indicators of quality based on the same variable. One indicator is the number of persons launching per minute on summer Saturdays and holidays, defined as the high-use indicator. The second indicator is the number of persons launching per minute on Sundays, weekdays and off-peak Saturdays, defined as the low-use indicator.

1998 Niobrara River Floater Survey

To evaluate the relationship between the indicators of quality and the visitor experience, we constructed a visitor survey based on a set of 12 photographs showing a range of visitor use levels. Photographs of the Niobrara River were taken from a boat anchored on the right bank within the wilderness area, looking across and down the river. The photographs were scanned and then combined into a panorama using Kodak *PhotoPaint*. Additional photographs of river floaters were also scanned, and individual images of tubes and canoes were digitally added to the background panorama. The result was a composite image containing 46 people, 15 in tubes and 31 in canoes. From this composite photograph showing the maximum number of users, we prepared 11 other views of the same scene by digitally removing individual vessels in random order, down to zero.

The photographs were placed in random order on a 4' x 3' display board. The text of the survey questions was also placed on the board along the top, in large type. The survey was brief and was focused on the visitors' response to the set of photographs. In question 1, we asked, *"Please examine the series of photographs showing the Niobrara River from the viewpoint of a visitor floating the river. For each photograph, indicate how acceptable the view is to you, using a scale where +4 is very acceptable, 0 is neutral and –4 is very unacceptable."* The second question referred to the same set of photographs, *"Now consider the series of photographs from the standpoint of wilderness solitude. Identify any photographs that* ***do not*** *represent your view of an acceptable wilderness experience."* Respondents were asked only two other questions, the number of previous float trips on the river, and the approximate size of their party. Other information recorded by the surveyor included type of vessel, day of the week and gender of the respondent.

The surveys were administered from a site in the parking lot of the Fort Niobrara Canoe Launch. Respondents were surveyed prior to launching their vessels. The board with the photographs was placed on the tailgate of a U.S. Fish & Wildlife Service vehicle. Different locations were used on each survey day, and respondents were selected from those nearest the vehicle. By varying the locations, we obtained a balanced sample of respondents from a variety of outfitters, because each outfitter is assigned one part of the launch area.

The results of survey question 1 show a strong relationship between the mean acceptability rating and the number of persons present in the view (fig. 1). The public gives a mean acceptability rating of only +1 to the 1997 average level of use on summer Saturdays (17 people in the view, or a rate of five people per minute). The results of survey question 2 appear in figure 2. The 50th percentile, the level of use that 50% of the respondents find acceptable, is estimated to be 27 people (nine per minute). Approximately 20% of the respondents report that the 1997 average level of use on summer Saturdays (17 people) is unacceptable.

Standards of Quality

Two standards of quality were identified from the results in figure 1 and figure 2. The carrying capacity of the resource can be inferred from the point where the mean acceptability rating crosses from positive to negative, at a value of approximately 24 persons in the view. That number corresponds to an average rate of eight persons launching per minute. Because carrying capacity represents an upper bound to acceptable use, a standard of eight persons launching per minute in the Fort Niobrara Wilderness is most appropriate for the high-use periods. However, a standard based only on an average rate is not adequate because the clumping of vessels frequently raises the rate above the average value. We recommend that the standard of quality

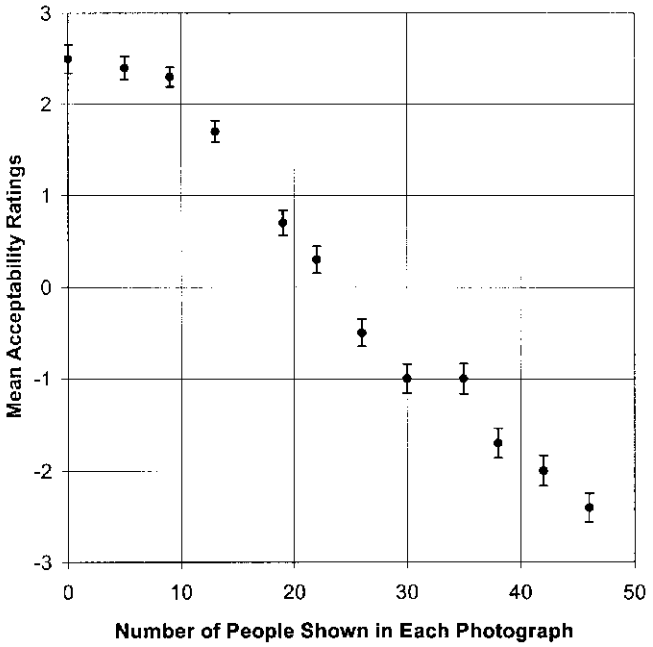

Figure 1—Results for survey question 1, in which the respondents rated the acceptability of the view in each photograph on a scale from –4 to +4. The mean acceptability rating and standard error of the mean are graphed as a function of the number of persons in each photograph.

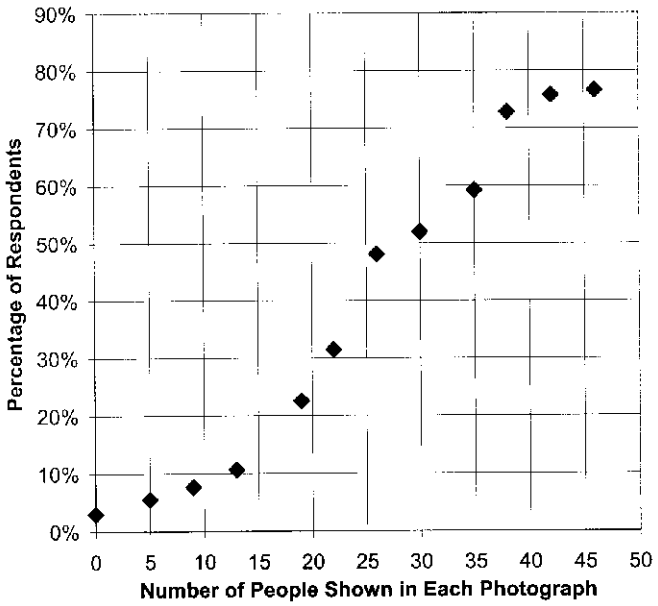

Figure 2—Results for survey question 2, in which the respondent selected any photographs that did not represent his/her view of an acceptable wilderness experience. The percentage of respondents who selected each photograph, out of the total of 235 respondents, is graphed as a function of the number of persons in the photograph.

for summer Saturdays and holidays should be, *"a rate of no more than eight persons launching per minute, at least 90% of the time."* The relationship between indicators and standards of quality is shown in table 1.

The second standard of quality can be identified from the level of use at which visitor satisfaction begins to drop. In figure 1, the average acceptability begins to decline significantly from its maximum value when the number of persons in the view reaches nine (three persons launching per minute). In figure 2, the same level of use occurs at the 10th percentile, which means 90% of the respondents find the level acceptable from a wilderness standpoint. We recommend that the standard of quality for low-use periods should be, *"a rate of no more than three persons launching per minute, at least 90% of the time."* This standard should be applied to the low-use periods on Sundays and weekdays to maintain visitor satisfaction at a level that preserves the wilderness quality of the experience during those periods.

Implications for Wilderness Standards

There is little difference between the responses to the wilderness question compared to the first question on general crowding. In figure 1, the neutral level of acceptability occurs at roughly 24 persons in the view. For comparison, in figure 2 the 50th percentile of acceptability is at a level of approximately 27 persons in the view. We expected respondents to be generally less accepting of other visitors when evaluating the photographs from a wilderness perspective rather than a general recreational perspective.

There are three possible explanations for this surprising result. First, the typical river floaters in the Fort Niobrara Wilderness may not be able to distinguish between recreational floating and a wilderness experience. Second, the majority of visitors may not be coming to the Niobrara River for a wilderness experience, possibly because crowding has already caused wilderness seekers to go elsewhere. Finally, the number of parties encountered by visitors may not be as important an indicator of quality of wilderness experience as the behavior of other visitors.

Management Goals Derived From Standards of Quality

Three management goals can be derived from the standards of quality identified during this process.

1) Distribute launch times during peak periods on summer Saturdays and holidays, to reduce the number of large clusters of vessels that exceed the rate of eight persons launching per minute.

2) Increase the level of wilderness awareness among the river floaters using the Fort Niobrara Wilderness, through an education and information program targeted at visitors in high-use periods.

3) Preserve Sunday and weekday periods as an outstanding opportunity for solitude on the Niobrara River in the Fort Niobrara Wilderness.

The first goal is intended to improve the quality of the visitors' experience during high-use periods. The average level of use on summer Saturdays and holidays has not yet exceeded the social carrying capacity of eight persons launching per minute, but the public's rating of the average level of

Table 1—Relationship between indicators of quality and standards derived for those indicators from the results of the 1998 Niobrara River Floater Survey.

Indicator of quality	Standard of quality
Average number of persons launching per minute on Saturdays and holidays	Rate of no more than eight persons launching per minute 90% of the time
Average number of persons launching per minute on Sundays and weekdays	Rate of no more than three persons launching per minute 90% of the time

use is significantly below the maximum possible level of acceptability. The low acceptability rating during high use periods may result as much from the uneven distribution of vessels on the Niobrara River as from the total number of floaters. Vessel clumping causes the standard of quality identified for high use-periods to be frequently violated on summer Saturdays and holidays.

The second management goal is aimed at improving the quality of visitors' wilderness experience during high-use periods. A successful education program would increase the awareness of visitors about the difference between recreational floating and a wilderness experience and would ideally lead to voluntary actions by the public to reduce noise, reduce group size and increase space between vessels.

The final management goal recognizes that crowding on Saturdays may lead to increases in traffic during periods that currently receive low use. While reduction of crowding on Saturdays is a desirable goal, the spreading of crowds to other days is not. We recommend that the focus of management actions should be to insure that Sundays and weekdays continue to present an opportunity for solitude, while simultaneously reducing or mitigating crowding during high-use periods.

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Keeping Wilderness Wild: Increasing Effectiveness With Limited Resources

Linda Merigliano
Bryan Smith

Abstract—Wilderness managers are forced to make increasingly difficult decisions about where to focus limited resources. Traditionally, areas of high visitor use and high impact are prioritized over areas of light use and light impact. However, areas that contain little to no human impact and contain the qualities that lead to the area's designation as wilderness are most precious and have the greatest potential to be responsive to management. We mapped attributes of the Gros Ventre Wilderness in Wyoming to demonstrate how the most precious, vulnerable and responsive areas can be identified and prioritized. This information shows how on-the-ground management attention can be shifted to more effectively retain the area's wilderness character.

Numerous studies of recreational impact in wildland settings have revealed that, with increasing use, impacts to the resource and to visitor experience accelerate quickly, then tend to level off. However, recovery is very slow after use is reduced (Cole and Hall 1992; Hammitt and Cole 1987). These results have been widely applied at the site scale to guide campsite management and to guide recreationists' behavior, as evidenced by the Leave No Trace principles "concentrate impacts in high use areas" and "avoid places where impact is just beginning" (Cole and Krumpe 1992). Wilderness planning efforts have also incorporated these results by developing a spectrum of zones to concentrate use in certain zones, thus enabling better protection for wilder portions of the wilderness, rather than trying to disperse use throughout the wilderness in order to meet one set of standards. However, results from wildland recreation studies have not yet been used to guide where on-the-ground management attention is focused.

Wilderness ranger presence is typically focused where visitor contact can be maximized, where impacts are perceived to be greatest, and where trail clearing needs are the greatest. All of these criteria lead the manager to schedule wilderness ranger presence in the more heavily used portions of the wilderness. The wilderness ranger job includes monitoring conditions but with increasingly limited resources monitoring is typically done along with other duties such as visitor contact, trail clearing, and campsite cleanup. Because wilderness ranger presence is focused in the more heavily used portions of the wilderness, monitoring data are scant to nonexistent in the more lightly used portions of the wilderness.

Recently, the traditional strategy of focusing management attention in heavily used areas rather than in lightly used areas has been questioned as to its long-term effectiveness in protecting wilderness qualities (Cole 1997). A compelling case has been made that lightly used areas are most precious, most vulnerable to change and most responsive to management action. By shifting the focus to monitoring and protecting lightly used areas, managers with limited resources can more effectively prevent impacts and ensure that more of the wilderness meets the spirit of the Wilderness Act.

The purpose of this project is to demonstrate how the conceptual framework of allocating on-the-ground management attention based on criteria of preciousness, vulnerability, and responsiveness can be applied and how this information can be used to prioritize where wilderness rangers spend their time. The Gros Ventre Wilderness in Wyoming is used as the demonstration area. This project was not done as part of a planning effort but rather as part of ongoing implementation of existing plans. The results of the analysis has three intended uses:

1) Identify priority areas to focus wilderness monitoring,
2) Identify areas most at risk if nearby roads were improved or other development activity occurred, and
3) Prioritize areas where proactive management action would be most effective.

The Demonstration Area

The 287,000 acre Gros Ventre Wilderness lies in the heart of the Greater Yellowstone Ecosystem on the doorstep of Jackson, Wyoming. Natural qualities leading to its designation included its "interesting and unique expressions of geology", such as one of the largest concentrations of landslides in Wyoming. Other key reasons for designation were watershed protection and protection of wildlife habitat, especially for elk and bighorn sheep. Although roughly three million people visit Jackson Hole each summer, the Wilderness receives light use (estimated at 30,000 recreation visitor days per year). This is largely due to the lack of easy access. Consequently, the Gros Ventre Wilderness is closest to the wilderness ideal when compared with surrounding wildernesses and national parks. Despite current light use, significant pressures exist that could increase impacts greatly in the future. These include potential for improved road access and greatly increased visitation from tourists, as well as residents seeking refuge from increasingly crowded and regulated areas.

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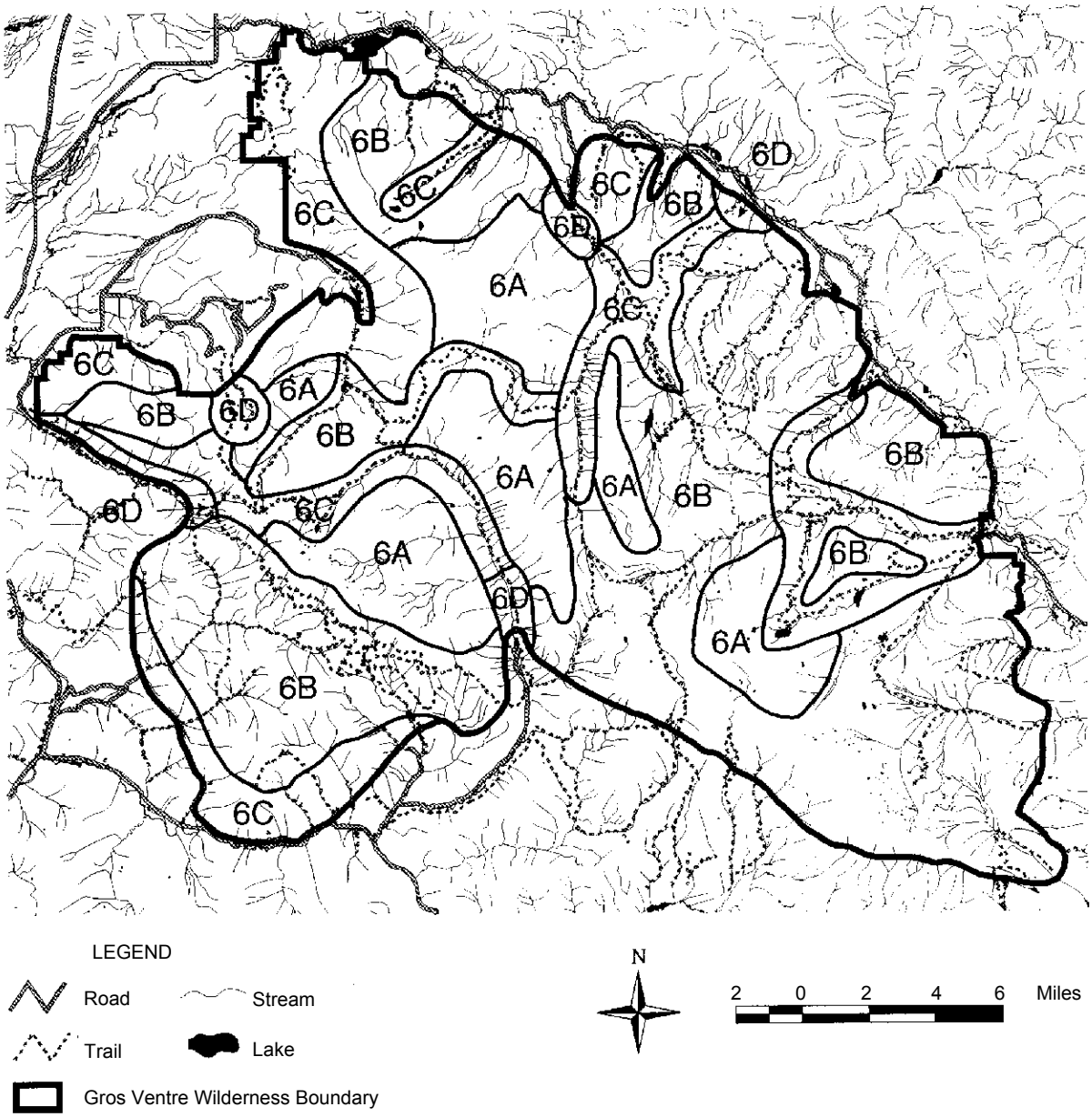
Wilderness management direction for the Gros Ventre is found in the Forest Plan (USDA Forest Service 1990) and the Wilderness Action Plan (and Implementation Schedule) (USDA Forest Service 1994). As part of this direction, the Wilderness is divided into four zones (6A-6D), ranging from an undisturbed setting (6A) to a natural setting where evidence of localized human use exists (6D) (fig. 1). Within each zone, standards for acceptable conditions have been established for trail development, campsite impact, grazing impact, and encounters between groups (table 1). Recently, the Forest has focused more attention on road management, and new funding has been obtained to significantly improve some existing roads. At the same time, there has been increasing recognition that how roads and other projects



6A: An undisturbed setting where little to no evidence of human presence exists.

6B: A relatively undisturbed setting where minor evidence of human presence exists.

6C: A relatively undisturbed setting where minor evidence of human use or presence exists, particularly in concentrated-use areas such as campsites and travel corridors.

6D: A natural setting where evidence of localized human use exists and encounters with other groups may be frequent.

Figure 1—Management zones in the Gros Ventre Wilderness.

Table 1—Management strategy and protection standards for priority areas.

Priority areas	Zone category	Management strategy	Key standards
Priority #1	6A	Impact prevention and elimination	Wildlife: human activity is prohibited in crucial winter ranges from Dec 15 to April 30; human activity is restricted in elk calving areas between May 15 and Jun 30. Grazing: cattle and domestic sheep are not authorized; maximum utilization of key forage species by recreational stock is 50%. Recreation: visitors encounter no more than one other group per day; no groups are camped within sound or sight of each other. Campsites: vegetation may be flattened but is not lost. There are no fire rings or other camp structures. Trails: existing routes look like game trails. No new routes are created. No signs, cairns or other trail markers exist.
Priority #2	mostly 6B, some 6C	Strong upward trend in conditions	Wildlife: same as priority #1 areas plus trail locations will be managed to protect elk wallow complexes. Grazing: range improvements, management activities and trailing will be designed to help meet wildlife habitat needs on key areas such as crucial winter range and seasonal calving areas; maximum utilization of key forage species is specified in individual allotment plans. Recreation: visitors encounter no more than four other groups per day; no more than two groups will be camped within sight or sound of each other. Campsites: vegetation is lost only around the fire ring or center of activity. Trails: system trails are passable but may be brushy. Tread is narrow and may be rocky; no more than an average of 0.2 miles of system trail per square mile of area exists.
Priority #3	6A	Stable conditions	Same as priority #1 areas
Priority #4	mostly 6B, some 6C	Upward trend in conditions	Same as priority #2 areas
Priority #5	mostly 6C, some 6B and 6D	Prevent impact spread; concentrate use on established sites.	Wildlife and Grazing: same as priority #2 areas. Recreation: visitors encounter no more than six other groups per day; no more than three groups will be camped within sight or sound of each other. Campsites: vegetation may be lost but mineral soil and tree roots are not exposed. Trails: Trails are narrow but well-defined and corridor is passable; no more than an average of 1.0 miles of system trail per square mile of area exists.

adjacent to the Wilderness are addressed will dramatically affect how wild this area is in the future.

Methodology

Lightly impacted areas best meet the criteria of preciousness since they are closest to the wilderness ideal. Lightly impacted areas are also most likely to change with increasing use (vulnerable) and most responsive to management (Cole 1997). Preciousness can also be defined as a characteristic of those areas offering the qualities that lead to wilderness designation. Of the three primary qualities leading to the designation of the Gros Ventre Wilderness (geology, watershed and wildlife protection), increasing recreational use is most likely to adversely affect wildlife. Thus, we based our prioritization on the overlap between those areas which have little to no impacts from recreation and grazing use (the two primary sources of human disturbance within the Wilderness) and those areas which are crucial in terms of wildlife habitat.

We first created an impact map displaying three categories of disturbance from human activities. Pristine areas were those containing no system trails and no inventoried campsites; they were also outside of any grazing allotment. Lightly disturbed areas were those areas containing secondary system trails, minor campsite impacts (few campsites with condition class ratings of 1 or 2), and minor grazing impacts such as trailing. Disturbed areas were those areas containing primary system trails (main travel corridors) and moderate campsite impacts (clusters of campsites with some condition class ratings of 3 or 4), and they were within core areas of grazing allotments. Four map layers were used to create the impact category map: the map of the four wilderness zones (6A-6D), a map of system trails, a map of campsite locations and condition class ratings and a map of grazing allotment boundaries. Field observations from wilderness rangers and a range specialist were used to supplement the map information. Next, we created a map displaying crucial wildlife habitat (winter range and calving/lambing areas) for elk, moose, deer and bighorn sheep. Crucial wildlife habitat is one of the layers in the Forest GIS database and was generated jointly by Wyoming Game and Fish Department and Forest Service biologists.

The impact map and crucial wildlife habitat map were then overlain to identify priority areas (fig. 2). We chose the strategy that it is most effective to "protect the best, then restore the rest." Thus, pristine areas were prioritized over lightly disturbed areas, and areas containing crucial wildlife habitat were prioritized over areas that did not contain crucial habitat. Using this logic, priority #1 areas are pristine areas containing crucial wildlife habitat. Priority #2 areas are lightly disturbed areas containing crucial wildlife

habitat. Priority #3 areas are the remaining pristine areas, and priority #4 areas are the remaining lightly disturbed areas. Priority #5 areas are the rest of the Wilderness.

Results and Discussion

In past years, wilderness ranger field presence in the Gros Ventre was focused in the more heavily used portions of the Wilderness in order to maximize visitor contact and work on trail projects located in the primary travel corridors (fig. 3). Based on the prioritization of areas where limited management attention has the greatest potential to keep conditions wild and retain the values for which the area was designated, a new map was generated to show how future wilderness ranger field presence would be distributed (fig. 4). Some current areas of heavy presence were designated medium presence areas, and some current areas of light or medium presence were dropped. This presence was then reallocated

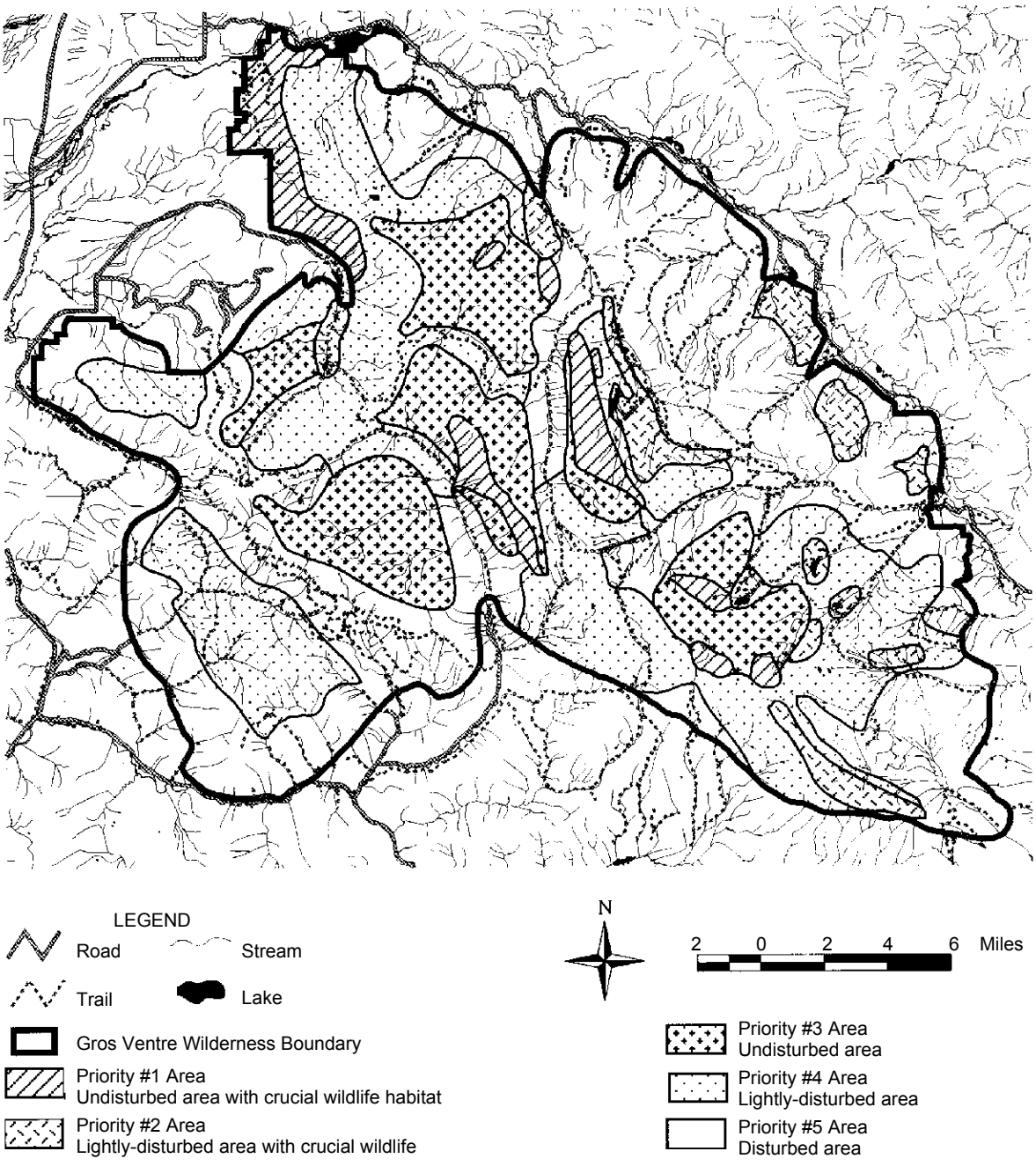


Figure 2—Priority areas, Gros Ventre Wilderness, where management will be most effective.

to increase presence in priority areas where there had previously been little to no presence.

As figure 4 shows, the strategy of focusing more management attention in lightly disturbed areas does not mean that the more heavily used portions of the wilderness are ignored. Management attention is still needed in heavily used areas to assist visitors, clear trails, prevent the spread of impacts and enforce regulations. Adopting this strategy also does not imply that heavily impacted areas cannot be restored with intensive management effort. However, most wilderness managers do not have the luxury to intensively manage the heavily used portions of the wilderness and also adequately ensure the protection of lightly impacted, wilder portions. In these cases, limited resources focused primarily in the heavily used portions do not significantly improve conditions over time and may lead to an overall decline in wilderness, especially if use in heavily used portions is inadvertently displaced while trying to reduce impacts. Managers with limited resources can be most effective in ensuring protection of wilderness by devoting as much attention to the

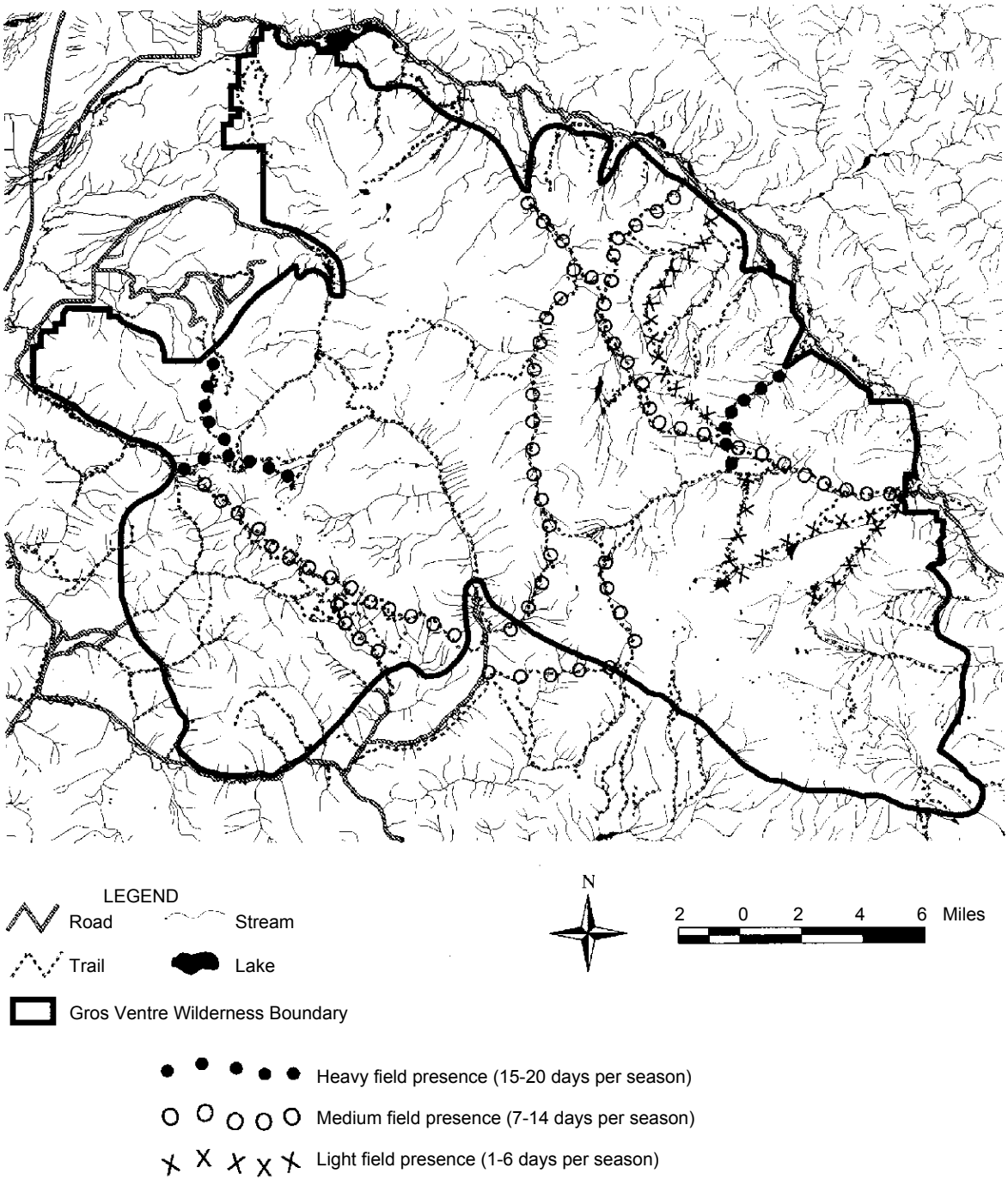


Figure 3—Current distribution of wilderness ranger presence, Gros Ventre Wilderness.

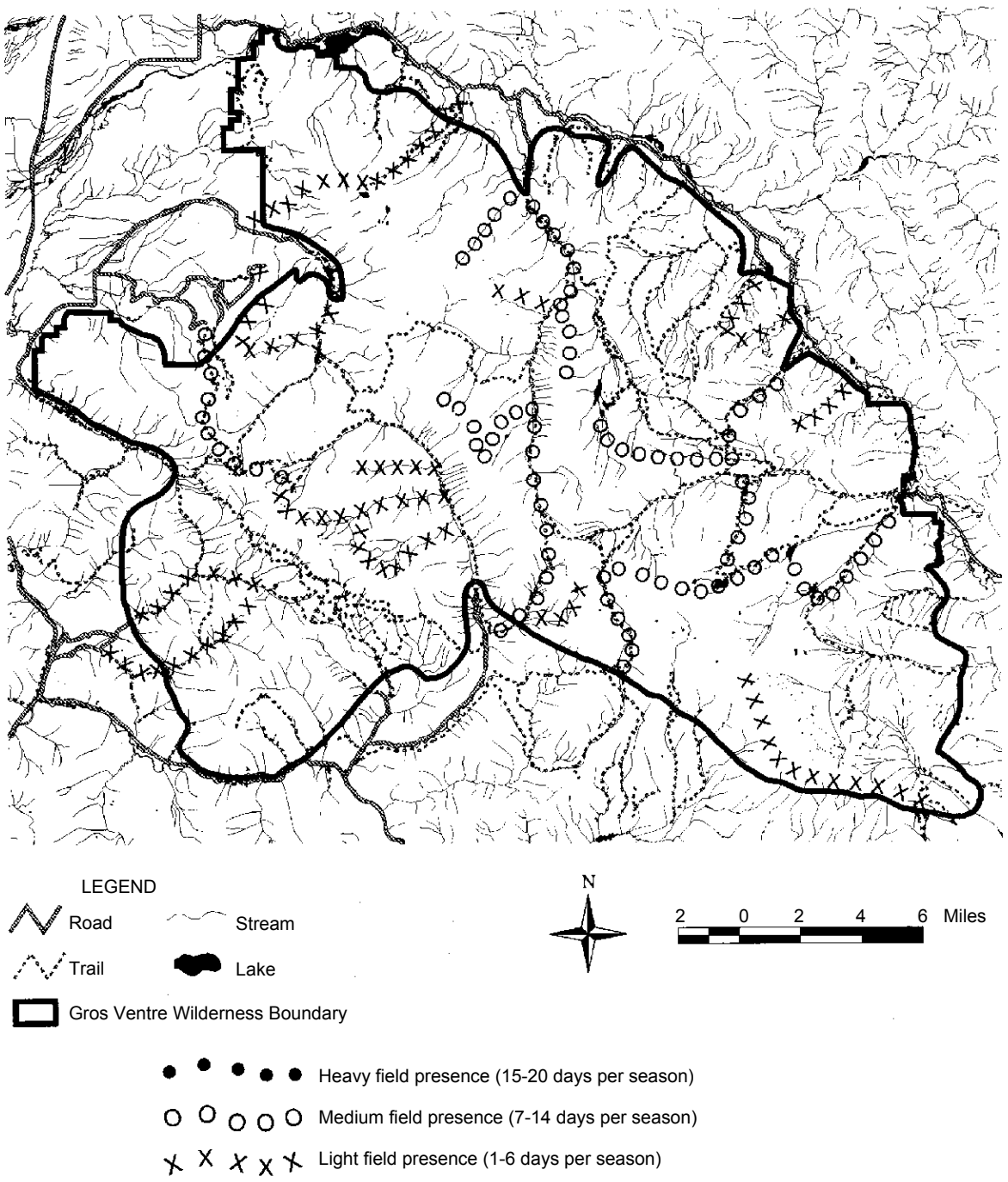


Figure 4—Future distribution of wilderness ranger presence, Gros Ventre Wilderness.

undisturbed and lightly impacted areas as the heavily used portions of a wilderness. Table 1 summarizes the management strategy identified for priority areas and the key standards for protection already established for these areas.

In the summer of 1999, we are using our prioritization of areas within the Gros Ventre Wilderness to direct wilderness ranger field presence. Wilderness rangers are thoroughly documenting existing conditions in the priority #1 and #2 areas. Information on which areas are most vulnerable to change and most precious is also being incorporated into the analysis of proposed improvements to existing roads. By thoroughly documenting existing conditions in portions of the Wilderness not typically monitored, we should be able to pick up changes in conditions early on, when there is far more potential to apply corrective action. Change is inevitable with the increasing recreational growth in the region, and some degree of road improvement is likely. The strategy of focusing more management attention on the most lightly used and precious portions of the Wilderness offers the best hope to protect the Gros Ventre Wilderness in the wildest state possible.

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Winter Visitor Use Planning in Yellowstone and Grand Teton National Parks

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Abstract—Winter use in Yellowstone and Grand Teton National Parks increased dramatically in the 1980s and early 1990s. That increase and the emphasis on snowmobiles as the primary mode of transportation brought into focus a host of winter-related issues, including air pollution, unwanted sound, wildlife impacts and the adequacy of agency budgets, staff and infrastructure to manage the burgeoning use. The increase has spawned several research and monitoring projects, five planning processes, two regulatory processes and, to date, two lawsuits. This paper is a case study of the ongoing planning, regulatory and legal aspects of winter use in these parks.

Winter recreation in Yellowstone and Grand Teton National Parks can be viewed from contrasting perspectives. One is the phenomenal scenery enjoyed by thousands of visitors each winter. Another is that the scenery and visitors have become a drawing card and source of economic development for communities near the parks. A third perspective is the possible impact on resources from those visitors: Visitors first began arriving in measurable numbers 40 years ago, and their impacts on a system that evolved over thousands of years with virtually no human intervention are unknown. Park staff has a different perspective, which involves managing visitor use in a natural area unlike almost any other in the lower 48 states. Another perspective questions the quality of the visitor experience and the effects on that quality of both passive and proactive management decisions. Finally, there are the planning and legal perspectives as all of these issues interact. This latter perspective includes five winter visitor use planning efforts, one petition for rule making, one promulgation of regulations and two lawsuits, so far. This paper is a case study of the last perspective and focuses on the planning and legal aspects of an ongoing land management issue (as of May 1999).

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The paper's primary focus is Yellowstone National Park, but similar issues for Grand Teton National Park and the John D. Rockefeller, Jr., Memorial Parkway are also addressed. The Parkway is a separate administrative unit of the national park system located between Yellowstone and Grand Teton and managed by Grand Teton National Park.

Winter in the National Parks

Winter in Yellowstone and Grand Teton National Parks evokes images of quiet and solitude. In contrast to the hustle of a summer day in the parks, where tens of thousands of visitors are congregating, winter is perceived by many as the quiet season, when they can be alone with nature. A summer day can see over 25,000 people in Yellowstone alone, while 2000 people may visit Yellowstone on a busy winter day. In summer as well as winter, visitors congregate at the developed destinations in Yellowstone and Grand Teton, such as Old Faithful, the Grand Canyon of the Yellowstone, Flagg Ranch, Moose and West Thumb Geyser Basin. Visitors are drawn to these locations in all seasons in large part because the parks' road network and developments are typically concentrated near the features. The road network in Yellowstone was laid out at the turn of the century, courtesy of the U.S. Army, to connect many of the Park's major geological features.

Nearly 90 percent of Yellowstone National Park is proposed wilderness, and over 98 percent of the Park is undeveloped and considered backcountry. The less than two percent that is developed contains the road network, utility corridors and developed areas. Winter visitors are also like summer visitors in that the vast majority do not stray far from the road corridors and developed areas. Summer and winter visitors traveling through the parks in motorized vehicles are confined to the road corridors and developed areas. Winter visitors to the parks travel by three primary modes: snowmobile, snowcoach and automobile. About 60 percent of Yellowstone's winter visitors enter the park via snowmobile, 30 percent are in an automobile and 10 percent are riding a snowcoach. Typically, about 15% of Yellowstone's visitors cross-country ski while in the park (Littlejohn 1996). Dispersed, off-road recreation is nonmotorized in nature. This is in contrast to other public lands around the national parks, where a combination of both road-based and dispersed motorized recreation is allowed, summer and winter.

As little as 30 years ago, winter travel in the national parks was only for the hearty and rugged few. Cross country skis were heavy wooden affairs, and early snowmobiles

almost required a complete tool kit and spare parts (or a spare snowmobile) if you wanted some assurance of completing a successful trip. Road surfaces were not groomed, and there were no warming huts or gas stations. Park staff overwintering in the interior of Yellowstone were primarily winter keepers, whose role - then and now - was to help shovel snow off roofs and generally keep an eye on the buildings and resources. Visiting the parks in the winter was truly an adventure, and getting there (and back) was more than half the fun. Other papers document more completely the history of winter use (Greater Yellowstone Coordinating Committee 1999; National Park Service 1990; Paganelli 1980; Yochim 1998).

Although limited over-snow vehicular travel began shortly after World War II, regular motorized travel did not take off until the 1960s when a combination of more reliable snowmachines and a supportive park administration made over-snow travel more feasible. In the late 1940s, communities near the Park requested that Yellowstone's roads be plowed for the winter to support better winter access to the parks and economic development for the communities. These requests continued over the decades, cumulating in U.S. Senate hearings in 1967 on the subject. The agency's decision was not to plow roads, but to support the existing, small-scale snowmobile travel. As a result, by December 1971, most of the basic infrastructure and facilities that are in use today were in place. The road network was groomed regularly, and the Snowlodge at Old Faithful (at that time, a converted employee dormitory) was being used for lodging (Yochim 1998). The 1971-72 winter recorded 29,248 visitors. Use more than doubled over the next decade (National Park Service 1990).

Action at the Presidential level in the early 1970s should have affected snowmobile use at Yellowstone, but did not. In February 1972, President Nixon signed Executive Order 11644 on *Use of Off-Road Vehicles on the Public Lands.* That Executive Order stated that trails may only be located in units of the National Park system when off-road vehicle use will not adversely affect their natural, aesthetic, or scenic values (Executive Order 11644 1972). Use of snowmobiles on road corridors has been defined as off-road vehicles use. As a result of this Executive Order, parks were directed to review snowmobile use. Some did, and based on the review, parks such as Glacier National Park, chose to ban snowmobile use. Yellowstone National Park apparently did not accomplish a written review (there is no evidence in the administrative records) and allowed snowmobile use to continue (Yochim 1998). Executive Order 11644 was amended and strengthened by Executive Order 11989 signed by President Carter in 1977 (Executive Order 11989 1977).

Things have changed in the past 30 years. The winter season in the parks lasts from mid-December to mid-March. Prior to mid-December, the park roads are closed to visitor traffic to allow enough snow to accumulate to support over-snow traffic. Beginning in early to mid-March, the Park closes, and roads are plowed to prepare them for the summer season. Park roads begin to reopen for wheeled vehicle traffic in mid-April, while the remainder open by late-May. In Yellowstone, the road from the Park's North Entrance to Cooke City, Montana remains open year-round for wheeled vehicle travel, as does U.S. Highway 191, which traverses the northwest corner of the park. Grand Teton National Park plows the road from Moran Junction to Flagg Ranch throughout the winter. Snow accumulations in the parks vary from about a foot in the Mammoth area of Yellowstone to over 10 feet in the Flagg Ranch and South Entrance areas of Grand Teton and Yellowstone.

To prepare for the winter season, the NPS and concessionaires must bring in and store all large or bulky supplies before the roads close. For example, all gasoline that is available for public sale or administrative use over the course of the winter is stored in underground fuel tanks by early November each year. Similarly, most garbage generated in the interior is stored for the balance of the winter and hauled out as the roads are plowed. The public as a whole often does not understand the infrastructure limitations; they assume that park facilities operate like their communities.

Burgeoning winter use in the 1980s caused the National Park Service to question whether the agency had the fiscal resources to adequately provide for winter visitors. These questions, and a desire to upgrade winter infrastructure, led to the preparation of a winter use plan for the parks. In the 1982-83 winter, visitation stood at 71,653. In the 1989-90 winter, just before the *Winter Use Plan* was completed for Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway, visitation was 98,249 (National Park Service 1990).

Within two years, winter use in Yellowstone exceeded the 1990 plan's projection for the year 2000 of 143,000 winter visitors. National forests in the Greater Yellowstone Area also observed rapid, but less well-documented increases. For example, snowmobile visitation on the Hebgen Lake District of the Gallatin National Forest increased from 47,552 to 84,800 between 1984-85 to 1995-96 (Greater Yellowstone Coordinating Committee 1999). For most of the other forest lands, use is not systematically recorded and is based on anecdotal reports by forest staff, other agencies and users.

This measured and perceived increase in use in the late 1980s and early 1990s set in motion planning processes in the parks and forests that continue to this day. The 1990 *Winter Use Plan* said that if visitation exceeded the year 2000 projection or if the Continental Divide Snowmobile Trail became operational in Grand Teton National Park, a process called "visitor use management" would be initiated. Both of those events happened in the winter of 1992-1993. The *Winter Use Plan* defines visitor use management as a process to identify more specific visitor experience and resource protection objectives, identify key impact indicators, establish a monitoring program and identify specific actions to manage impacts within acceptable limits (National Park Service 1990).

However, the pattern of increasing visitation changed in the mid- to late-1990s. Visitation in Yellowstone National Park went down, dramatically, reaching a nadir of 113,504 in 1996/1997. Visitation has hovered around the 115,000-125,000 level since then. What happened in the 1990s to cause this reduction in use? We do not know the exact causes, but we believe a number of events influenced visitation.

The national parks experienced some poor snow years, so the parks actually closed prematurely in the spring due to lack of snow. Also, in many years, the parks experienced repeated warm days and nights, making it difficult to groom roads effectively. When this happens, the snow roads become extremely rough, with moguls up to three feet high

after as few as 300 to 400 snowmobiles pass by. Riding conditions become deplorable, if not downright unsafe. Snowfall in other parts of the country, especially the upper Midwest, was excellent in some of those years, which may have kept people recreating closer to home. Short-term weather events also contributed to the decline in use. In 1997, it was raining at Old Faithful on New Year's Day. The snow turned to slush, and Yellowstone closed. The Federal Government shut down in late-1995 and early-1996, and the parks were closed for three weeks. As part of the fee demonstration program, entrance fees increased from $4/person to $15/snowmobile in December 1996. In early 1994, the National Park Service began publicly expressing misgivings about increasing winter visitation. The media, some local communities and tourism agencies translated these concerns into a notion that the parks were (or were about to be) closed. We continue to get inquiries from potential visitors asking if the parks are open.

In addition, we believe the nature of how people learn about and plan their trip to the parks in the winter has influenced visitation levels. Visitor surveys tell us that many people decide and plan their trip based on previous trips and talking with other people, especially family or friends, rather than park or tourism agency sources (National Park Service 1995; Northwest Wyoming College 1999). If they, or people they know, have had (or perceive) a bad experience, they are not going to return.

Going back to the early 1990s, we need to remember that park and forest staff had experienced close to a decade of measured and perceived growth in visitation. In some years, the percentage increases were double digit. Park staff could see no impediments to increasing use in the future. The snowmobile industry, chambers of commerce, and state tourism bureaus were all promoting winter in Yellowstone and Grand Teton National Parks. The parks themselves, and concessionaires, were contributing to that promotion. Communities like West Yellowstone, which not too many years before almost shut down in the winter, had developed into a self-styled "snowmobile capital of the world." More than 1,000 rental snowmobiles were available for park and forest visitors in this one community.

Other issues associated with increased use were at the forefront for park staff. This included concerns about emissions and air quality, unwanted sound, impacts to wildlife, adequacy of agency staff and budgets, and adequate infrastructure. These concerns initially led the two parks to work together in 1993 to develop an action plan to implement the short- and long-term steps that the 1990 *Winter Use Plan* identified (National Park Service 1993). Park staff discussed these with the national forest personnel, who echoed their concerns.

The Interagency Winter Use Report

In early 1994, after a winter tour of park and forest lands, the national forest supervisors and national park superintendents who make up the Greater Yellowstone Coordinating Committee agreed to coordinate a review of winter use in the Greater Yellowstone Area. The managers requested that their agencies' staff work together to provide a report on winter recreation. The report was to encompass winter recreation on more than 12 million acres of federal lands and cross the boundaries of three national park units and six national forests (the Targhee, Custer, Gallatin, Shoshone, Bridger-Teton and Beaverhead-Deerlodge). The forests transcend the boundaries of three U.S. Forest Service regional offices.

A team of 15 to 20 staff was formed over the course of 1994 to respond to the Greater Yellowstone Coordinating Committee's request. Individual units made staff assignments, and staff were to work on this project, in addition to their normal duties. Funding for staff salary and travel was up to the individual units, while the National Park Service paid for supplies, printing and the cost of facilitators from the NPS Denver Service Center. The group made an early decision to adopt the NPS Visitor Experience and Resource Protection process (VERP). That process was still in a testing and development phase, primarily at Arches National Park, but the forest and park staff believed that it held promise for this application. The working group requested staff from the NPS Denver Service Center, who were helping develop and test the VERP process to serve both as advisors and facilitators for the interagency team.

The National Park Service developed the VERP process in response to the 1978 National Parks and Recreation Act. That law directs the NPS to establish and implement carrying capacities for units of the national park system. VERP is founded on the "limits of acceptable change" process published by the U.S. Forest Service in 1985 and shares a common set of elements. Those include a description of the desired future conditions, identification of indicators of quality visitor experiences and resource conditions, establishment of standards that define the minimum acceptable conditions, monitoring to determine if management actions must be taken and taking management actions to ensure that indicators are maintained within specified standards. VERP is intended to be integrated into national park planning and focus on the impacts of visitor use on the visitor experiences and the park resources. These impacts are primarily attributable to visitor behavior, use levels, types of use, timing of use and location of use (National Park Service 1997a).

The assessment included using the U.S. Forest Service's landscape analysis process to look at winter recreation and ways to improve visitor experiences while protecting the environment. Managers, interest groups and the public have expressed concern about a variety of issues surrounding winter use. The assessment describes issues as being within a user group (skiers versus skiers), between user groups (skiers versus snowmobilers), with natural resources (recreationists using winter wildlife habitat), and trespass into restricted areas. The report describes multiple issues in certain areas as well.

The landscape analysis utilized the Geographic Information System (GIS) to create database layers of lands currently open to winter use, existing use areas (motorized and nonmotorized) and visitor use issues. As the project began in 1994, few unified Greater Yellowstone Area-wide GIS layers were usable. Even accurate boundaries of the different units did not exist in a consistent and usable computer format. Some units lacked GIS staffing. Therefore, developing maps was a time-consuming, labor-intensive process.

The team created other data layers using natural restrictions to winter recreational use, such as areas of low snow and difficult slopes (the team considered slopes greater than 30% inaccessible to the average user). The team used these two restrictive layers to develop maps for areas that could potentially be used by either motorized or nonmotorized users. Once the team created these layers, they assessed them and created a map of potential future recreational areas (Analysis Results map). This Analysis of Results is not a final decision plan. Rather, the analysis is a guiding tool in future planning processes for all units.

As this process evolved, the team recognized the limited information available on winter recreation and wildlife. The team requested two bibliographies that compiled the literature available on this topic (Bennett 1995; Caslick 1997). In 1997, an interagency wildlife team was created to examine specific natural resource issues, such as impacts of recreation to an individual wildlife species, or more general topics, like impacts to vegetation. Wildlife biologists wrote individual research review papers on each identified topic, describing possible or known impacts and management recommendations. These are being compiled into a report, *The Effects of Winter Recreation on Wildlife: A Literature Review and Assessment*, that will be printed in mid- to late 1999 (National Park Service, in press).

The team released a draft interagency assessment for public review in the summer of 1997. The public review period for this document was 120 days, and the team received 5,800 comments (in 1,216 separate letters). Comments ranged from reiteration of previous concerns about winter use to specific points about the preliminary report. The team addressed comments and incorporated those that were appropriate in the final report.

In addition to public comments the States of Wyoming, Montana and Idaho expressed a concern that their winter recreation management activities were not well-represented in the assessment. Team members met with representatives from each state to listen to and gather information about the states' programs. The team incorporated these into the report, and the state representatives reviewed the report before it was finalized. The final report, *Winter Visitor Use Management: A Multi-Agency Assessment,* was printed in the spring of 1999.

The interagency report collates information on winter recreation in the Greater Yellowstone Area. The report makes no decisions about implementing management actions or reallocating land uses to address issues. Rather, it defers all decisions to unit-specific planning, such as forest plan revisions for the national forests or new winter use plans for the national parks (Greater Yellowstone Coordinating Committee 1999).

Lawsuit

Just before the release of the draft interagency report, the Fund for Animals and other organizations and individuals filed suit against the National Park Service in U.S. District Court in Washington, D.C. over winter use in Yellowstone and Grand Teton National Parks. In the winter of 1996-1997, about one-third of the bison living in Yellowstone National Park died. Some starved, but federal and state wildlife staff killed many because they strayed from the Park and were believed to pose a potential source of brucellosis for livestock. The Fund for Animals and other plaintiffs filed suit, alleging that the winter roads in the Park had eased bison departure (The Fund for Animals v. Babbitt (D.D.C., Civ. No. 97-1126)).

The lawsuit identified three primary complaints. The plaintiffs alleged that the Park Service had failed to prepare an environmental impact statement concerning winter use in Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway. They also alleged that the NPS had failed to consult with the U.S. Fish and Wildlife Service on the impacts of winter recreation on threatened or endangered species and had failed to evaluate the effects of trail grooming in the parks on wildlife and other park resources.

On October 27, 1997, the court approved a settlement agreement. Under the terms of the agreement, the National Park Service agreed to prepare a new winter use plan and corresponding environmental impact statement, to consult with the U.S. Fish and Wildlife on the effects of winter use on threatened and endangered species and to prepare an environmental assessment in the winter of 1997-1998 to evaluate the effects of temporarily closing a segment of road to study wildlife movements on groomed roads within the Park.

Road Closure Assessment

The most immediate outcome of the settlement agreement was preparation of an environmental assessment to analyze possible winter road closures to study wildlife movement. The purpose of the assessment was to analyze the benefits and costs of a winter road closure on understanding bison use of winter roads and on the visitor experience and local economies.

Wildlife use of the groomed winter roads has been an issue for a number of years, with some biologists and winter recreationists arguing that winter roads impact wintering wildlife. They say that the groomed roads provide an energy-efficient route for the animal movement, leading to population increases and changing distribution and habitat use patterns (Meagher 1993). Some argue that groomed roads contribute to bison migration out of the Park. With the population increases and easier movement, some also argue that groomed roads have increased the number of bison killed outside the Park. Others assert that there is no relationship or no effect of groomed roads on wildlife (National Park Service 1997b).

The assessment considered two road segments for possible closure. On Yellowstone's east side, the Park proposed closing the segment between Fishing Bridge and Canyon through Hayden Valley. On Yellowstone's west side, the closed segment would be between Norris and Madison along the Gibbon River. Neither segment would be closed at the same time as the other, and the implementation schedule would vary between segments. The Park chose these segments because bison used the areas that included the road segments and because closing either of the segments would not deny visitor access to all of Yellowstone's major features (such as the Old Faithful and the Grand Canyon of the Yellowstone). All entrance roads would have remained open, and all features would have been accessible; however, travel

to some of those features would have been much longer from some entrances.

The Park completed the *Environmental Assessment-Temporary Closure of a Winter Road, Yellowstone National Park* in November 1997 and placed the document on public review for 45 days. A total of 2,742 letters containing 6,443 different comments were received during the comment period. On January 16, 1998, the National Park Service signed a Finding of No Significant Impact that deferred a road closure because further research was necessary before closing a road would provide useful research information. At the end of three winter seasons (Fall 2000), the park will evaluate ongoing research and monitoring efforts and determine if a road closure is warranted. All road segments were to be considered for possible closure, not just the two identified in the environmental assessment. If a decision is made to close a road, the National Park Service is committed to providing one year's notice to the public. The Park Service believed there was a lack of information about wildlife use of the groomed roads, and that information should be gathered first, while the roads are open and available to the public.

Another Lawsuit

On February 18, 1998, the Fund for Animals and other organizations restated their concerns about the road closure decision by filing suit against the National Park Service to enforce the settlement agreement, again in U.S. District Court in Washington, D.C. The plaintiffs alleged that the National Park Service did have the necessary data to make the decision to close a road segment in Yellowstone. In addition, the plaintiffs alleged that the unlimited road grooming and lack of winter-use management practices were harming the plaintiffs' short- and long-term interests in recreating and in protecting and observing and studying the environment and wildlife within Yellowstone. They also alleged that the Park Service violated the settlement agreement by failing to close a road. During an October 1998 hearing on the lawsuit, the court combined the February 1998 action with the earlier lawsuit and granted intervention status to groups and individuals representing snowmobile and commercial interests.

On March 31, 1999, the U.S. District Court upheld the Finding of No Significant Impact for the temporary winter road closure environmental assessment. The court reasoned that the Finding of No Significant Impact was not arbitrary and capricious and did not violate the settlement agreement. The court also deferred deciding on whether continued road grooming violated the Organic Act and the Endangered Species Act until a new winter use plan and environmental impact statement are finished. However, the court retains jurisdiction to enforce the settlement agreement, and the judge expected that some of the issues raised by the plaintiffs would be addressed in the forthcoming environmental impact statement for the new winter use plans.

New Winter Use Plans

The other major outcome of the October 1997 settlement agreement was the preparation of new winter use plans for Yellowstone and Grand Teton National Parks, along with an environmental impact statement. The settlement agreement specified that the draft plans and environmental impact statement be made available for public review by August 1, 1999, and the final plan be completed by September 1, 2000. The National Park Service regional director will sign the Record of Decision about October 1, 2000. In the settlement negotiations, the plaintiffs demanded that no more than three winters pass before the Park Service reach decisions on a new winter plan. The plaintiffs wanted those decisions implemented by the 2000-2001 winter season.

The settlement agreement also identified the NPS would ask the U.S. Forest Service to be a cooperating agency under the provisions of the National Environmental Policy Act (NEPA). NEPA specifies that federal, state or local agencies or Indian tribes may be designated cooperating agencies on the basis of their special expertise or legal jurisdiction. Soon after the settlement agreement was signed, counties and states around the Park requested that they also be designated cooperating agencies. In early 1998, the Director of the National Park Service agreed that three states (Wyoming, Idaho and Montana) and five counties (Park and Teton in Wyoming, Fremont in Idaho and Park and Gallatin in Montana) would also be invited to be cooperating agencies. As cooperators, the states or counties have no jurisdiction over the decisions to be made by the national parks in winter use planning. Memorandums of Agreement identified the cooperators' special expertise, which was primarily socioeconomic. In addition, the states identified special expertise in matters related to air quality and wildlife.

An early question in the planning process was whether to continue with the commitment to prepare winter use plans or, instead, spend the time and money to prepare a General Management Plan. General Management Plans are to provide broad direction for resource preservation and visitor use. The 1978 National Parks and Recreation Act (P.L. 95-625) requires that all units have a current General Management Plan. Yellowstone and Grand Teton National Parks have master plans, predecessors to the General Management Plans, that were approved in 1974 and 1976, respectively. National Park Service management was concerned that the time and money needed to complete a winter use plan could be better devoted to a General Management Plan that would address winter, as well as spring, summer, and fall use.

Because of the short time frame and number of cooperators, the Park Service decided to defer General Management Plans and proceed with winter plans. That decision was reached in March 1998, but National Park Service funds for the winter plans were limited to $800,000. Earlier estimates had been about $2.2 million dollars to complete the effort. To make up the shortfall, the parks have used park base funding and fee demonstration money to pay staff members working on the project and to fund natural and social science-related studies to better understand winter issues.

After the settlement agreement was signed, the Park Service envisioned that the planning team consisting of staff from the two parks, with the bulk of the team members from the Denver Service Center. Staffing has proven problematic, however.

Two key individuals at Grand Teton National Park who were involved in the interagency assessment left the Park in 1998. In addition, the Denver Service Center was downsized.

In the mid-1990s, Congress became concerned about the expense of accomplishing construction projects in the national parks and the inability of the Park Service to explain how it prioritized its construction projects. The National Park Service had one of the largest central planning, design and construction supervision offices of the civilian federal agencies, with over 700 employees in the early 1990s. A review by the National Academy of Public Administration recommended that the number of federal employees be dramatically reduced at the Denver Service Center and that their work be accomplished by contractors (National Academy of Public Administration 1998). By early summer 1999, about 260 full-time employees will be at the Denver Service Center. Several Denver-based winter plan team members left the team by early 1999 and have not been replaced.

In May 1998, the National Park Service approved a new planning guideline, Director's Order 2. The guideline revamped how General Management Planning was to be done for the parks, focusing on broad goals to be achieved for the unit, rather than addressing specific issues. Concerns about General Management Plans had focused on their cost, length of time to prepare, and limited shelf life (often only until the next superintendent arrived). The new guideline addresses why a unit exists and what the desired future conditions of a park are to be. The guideline defers specifics of how to achieve those desired future conditions to later site-specific planning. The intent is to be more prescriptive rather than descriptive about a park, to give management the flexibility to respond to varying issues in the future (National Park Service 1998). This new guideline was adopted for use in the winter plans, which meant that the team members, especially those in the parks, had to learn new vocabulary and approaches to planning while in the midst of preparing the plan.

The team accepted public scoping comments on the winter use plans and environmental impact statement from April 14, 1998 to July 18, 1998. It mailed scoping brochures to 6,000 interested parties and held 16 public meetings throughout the Greater Yellowstone Area and the states of Idaho, Montana and Wyoming. In addition to local area and regional meetings, the team held national meetings in Salt Lake City, Denver, Minneapolis and Washington D.C. The team received approximately 2,500 comment letters.

The cooperating agencies have continued active involvement in the winter use EIS process. In October 1998, the National Park Service and the cooperating agencies met in Idaho Falls, Idaho, to formulate initial concepts for alternatives. Twenty-five participants and approximately 10 observers attended the three-day workshop. Both parks held similar workshops during the week of October 26. The team incorporated the majority of the ideas generated at the workshops into draft preliminary alternatives.

In late January 1999, the team presented preliminary alternatives to the National Park Service's regional director, who will eventually sign the Record of Decision. Intensive reviews at the Park Service's regional and Washington, D.C. offices, and by the Assistant Secretary for Fish and Wildlife and Parks occurred over the next three months. The team released the draft preliminary alternatives to the cooperating agencies on April 22, 1999. In keeping with the new planning guidelines, these alternatives prescribe the desired future conditions for the parks, but they do not describe the specific implementation steps. The analysis of the alternatives is currently underway, and the team asked the cooperators to provide information that will assist in that analysis.

A 60-day extension of the August 1 deadline was requested of the plaintiffs, who responded favorably, if the National Park Service would agree to two conditions. First, the National Park Service had to initiate public comment on the Bluewater Network petition (see below) by April 21, 1999 and complete response to the petition within one year of its submission (January 2000). In addition, the Park Service was asked to delay grooming the winter roads until December 15, 2000, in order to allow judicial review of the Record of Decision due for approval in October 2000. The Park Service did not agree to the conditions. Negotiations resulted in a two-week extension for release of the draft plan and EIS (until August 15, 1999).

The Bluewater Network Petition

The Bluewater Network petition was one of two twists in the winter use saga in 1999. In January 1999, a coalition of environmental groups represented by the Bluewater Network filed a petition with the National Park Service to ban snowmobiles from all 28 national park units where they were allowed (Bluewater Network 1999). Of the 28 units, snowmobile use is common in only about seven (Yellowstone, Grand Teton, Denali, John D. Rockefeller, Jr., Memorial Parkway, Voyagers, Rocky Mountain and Crater Lake). For many of the rest, it is typically incidental and often for in-holder use.

The Park Service is currently developing a response to the petition. In the meantime, the petition affected the new winter use plan in two ways. First, evaluation of the petition delayed the review and approval of the draft alternatives by more than two months. Second, the team added an alternative that would make the mode of over-snow transportation snowcoaches, essentially banning snowmobiles.

EPA Regulations

The other twist occurred in February 1999. The U.S. Environmental Protection Agency initiated the regulatory process to establish emission rules for snowmobiles as part of an effort to control oxides of nitrogen, hydrocarbons and carbon monoxide from large nonroad, spark-ignition engines (Environmental Protection Agency 1999). EPA's first step in the regulatory process was to publish a proposed finding on the amount of emissions that these engines contributed to the nation's air pollution. Most of the draft alternatives call for emissions reductions, but those alternatives may or may not coincide with the forthcoming EPA regulations.

Research

Since 1994, a number of research, monitoring and literature reviews have been underway to help national park (and other) managers understand winter use issues. Many of these studies are ongoing and reports are being prepared, so reviewed and published results are not always available.

This paper references some of the complete studies. Many of the research results will be available after the new winter use plans are completed in the fall of 2000. Thus, much of the information will be most useful in guiding actions taken to implement the winter plans. This section focuses on the information that the studies will add to our knowledge base.

Wildlife has been a key concern of the public and the agencies for some time. Information from two literature searches (Bennett 1993; Caslick 1997) and other literature reviews was organized into a series of papers that evaluate the effects of winter recreation on wildlife. The report, *The Effects of Winter Recreation on Wildlife: A Literature Review and Assessment*, is in press and should be completed later this summer. Several current wildlife monitoring and research projects that should help us better understand the effects of groomed roads and winter recreation on wildlife, especially bison and elk.

Air quality has been a key concern centered on emissions from snowmobiles. A variety of laboratory and field studies have measured emissions, exposure of employees and visitors to emissions, deposition of pollution in the snowpack, and pollution in snowmelt. Some of the studies have also looked at the effects of using oxygenated fuels and biodegradable lubricants to reduce pollutants (Bishop and Stedman 1998; Ingersoll and others 1997; Radtke 1997; Snook and Davis 1997; State of Montana undated; White and Carroll 1998; Wright and White 1998;).

Related to the air quality issues are efforts to create a clean and quiet snowmobile. A private citizen and a Teton County, Wyoming commissioner are organizing the Clean Snowmobile Challenge 2000. The challenge is a student design competition sponsored by the Society of Automotive Engineers to develop a cleaner and quieter snowmobile with good performance characteristics. The challenge is set for March of 2000 in Jackson, Wyoming. A Montana-based company has been exploring the possibility of building an electric (battery-powered) snowmobile. We hope to see a prototype of the machine this coming winter.

Visitors and park staff identified crowding and the degrading quality of the visitor experience as concerns. A series of visitor studies have been done to investigate these issues, beginning with Littlejohn (1996) and culminating in the paper being presented by my colleagues from the University of Montana and University of Vermont as part of this conference (Borrie and others 1997).

Gateway communities, counties and states are concerned that any change in visitor use patterns will affect businesses and economies, so economics is a key issue. To aid understanding of the economic issues, a series of surveys are being conducted in 1999. A winter visitor survey was done in 1998/1999, a regional and nationwide telephone survey is taking place this spring and a summer visitor survey is underway. These surveys, all asking similar questions about winter use and bison management issues, will provide us a three-season regional and nationwide picture of public opinion of these issues. The visitor surveys are exploring visitors' willingness to pay for certain management actions, such as clean and quiet snowmobiles.

Unwanted sound, or noise, is a concern highlighted by park staff and visitors alike. It is also one of the least studied concerns. Some limited ambient sound monitoring has occurred in Grand Teton National Park along the Continental Divide Snowmobile Trail. The key goals that the National Park Service would like addressed are a field-friendly way to measure the sound created by a snowmobile and to evaluate the sources of snowmobile sound so that a quieter snowmobile can be produced.

Snowmobiles create moguls as they slightly accelerate and decelerate, which creates small ridges in the snow that are pushed up into a series of bumps that may be three feet from top to bottom. Creation of these moguls is more likely during warm conditions and are a primary complaint of visitors who must travel miles over rough trails. Studies of the mechanics of moguls, how to groom the snow surface better, and how to advise visitors of the conditions they are going to face will be underway next winter.

These research topics address the key issues raised by park staff and the public over the past decade. The results should help park managers adjust how the new winter use plans are put in place.

Conclusion

This paper presents a case study of a land management issue that is in progress. The winter recreation issue will continue to evolve, as it has over the past decade, and a paper presented a year from now on this topic will certainly present some different perspectives. However, a couple of conclusions will probably hold true. The highly contentious nature of the winter use issue will continue, and any changes (or the status quo) will be scrutinized and intensely debated in the public forum. Since 1990, the National Park Service has been involved in a variety of planning processes to address winter recreation. Each process has reach a similar conclusion. Decisions have been deferred, to another planning process, to the collection of additional monitoring and research data, or both.

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5. Dialogue Session Summaries

Wilderness Education: An Updated Review of the Literature and New Directions for Research and Practice

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Abstract—Many scientists, managers and advocates for wilderness consider education key to promoting appreciation and understanding of the cultural, environmental and experiential values of wilderness. Despite the large variety and diversity of wilderness information and education techniques, little research exists on the design and application of wilderness education programs and how effectively they influence levels of knowledge, attitudes and beliefs about wilderness.

Most research conducted on wilderness education programs focuses attention on adult and young adult participants, and only a few have focused on wilderness education programs for school-age children. Wilderness education needs to expand beyond instructing visitors to teaching a shared understanding of the role and value of wilderness to society.

The purpose of this session was to provide an up-to-date review and synthesis of the research in wilderness education, present examples of current wilderness education research, discuss the role of the federal line officer in wilderness education and work with session participants to determine new directions and priorities for research on wilderness education.

Many wilderness managers and researchers consider wilderness education a key component to the long-term survival of wilderness. Wilderness education can inform people about the benefits of wilderness; it can help make them aware and appreciative of the cultural, environmental and experiential values of wilderness; and, it can help shape human behavior within wilderness.

Wilderness education has a number of definitions, depending on the context and the purpose of particular wilderness education programs. Bachert (1987) stated that wilderness education is "education in the wilderness-implying a place; education about the wilderness-implying a topic; and education for the wilderness-implying a reason." In the first case, education in the wilderness usually applies to organized programs such as the National Outdoor Leadership School, that conduct educational and development programs in wilderness. The session did not cover this component of wilderness education. Rather, its focus was on education about wilderness and education for wilderness.

There are a number of methods used for education about and for wilderness. These include wilderness management agency and advocacy group publications and videos, website information, Leave No Trace materials and training, brochures and displays at ranger stations, trailhead signs, interpretive displays and programs, personal education onsite by wilderness rangers and school-based wilderness curriculums.

Wilderness management agencies tend to prefer wilderness education that influences wilderness visitor behavior over other management techniques because education maintains elements of personal freedom and choice that other alternatives do not. In the past, much managerial attention has been on visitor training on low-impact camping techniques and user ethics. But managers and researchers are now saying that wilderness education should move beyond instructing visitors, to building a shared understanding of the role of wilderness in a broader societal perspective. The wilderness message must reach a broader spectrum of the American public. One such approach is an effort by the Arthur Carhart National Wilderness Training Center to develop and distribute school-based wilderness education curriculum programs.

An indication of the importance managers and researchers place on wilderness education comes from a study done of 424 participants at the 1994 National Wilderness Conference in Santa Fe, New Mexico (Barns 1997a, 1997b). These participants identified and prioritized strategies for wilderness stewardship in this country. Of the top seven strategies, two dealt with wilderness education, and one specifically dealt with wilderness education to grades kindergarten through twelve (K-12).

Yet, despite the variety of wilderness education approaches now used and the importance placed on wilderness education, there has been little research conducted on the design, application and effectiveness of most wilderness education programs in changing levels of knowledge, attitudes and

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beliefs about wilderness. Many wilderness education methods are effective and have some impact on people's awareness and appreciation of wilderness, as well as how they behave in wilderness. But there are very few studies that actually document those increases in awareness, appreciation or behavioral changes. We need good research to know if we are spending our resources in areas that actually are effective, and how we can improve and change education approaches to make them more effective.

Examples of Evaluative Studies of Wilderness Education With School-Age Children

Most research conducted on wilderness education programs focuses attention on adult participants in adventure/experiential education programs. A few studies have focused on K-8 level wilderness education programs (Beaver and Jacobson 1985; Dowell and McCool 1985; Hendricks 1999; Hendricks and Watson 1999; Knapp 1996; Oye 1984; Tracy 1995). The results of these studies show increases in knowledge (cognitive) and short-term behavioral gains, but no long-term behavior changes.

Oye (1984) looked at cognitive and affective changes resulting from a wilderness education program directed at sixth grade students. The study results indicate that an hour-long wilderness education program significantly increases knowledge scores, but it does not change attitudes toward wilderness. No valid attempt was made to evaluate how long the students retained the newly acquired information.

A study conducted by Dowell and McCool (1985) titled, "Leave No Trace" (LNT) evaluated the cognitive and affective changes as a result of a LNT program for Boy Scouts (10 to 18 years of age). Results indicate an overall improvement in wilderness knowledge, skills and behavioral intentions after exposure to the program. However, retention scores dropped significantly for behavioral intentions within a month after the presentation.

Knapp (1996) evaluated the influence of environmental education programs on students' environmental knowledge, attitudes and/or behaviors. The year-long project provided environmental education to middle-school teachers and students and promoted their involvement in the management of the Charles Deam Wilderness in south central Indiana. Of the three variables (knowledge, attitude and behavior) evaluated, only knowledge questions showed significant increases during the year-long program. The attitude and behavior variables did not reflect a significant increase.

Through support from the Aldo Leopold Wilderness Research Institute, the Arthur Carhart National Wilderness Training Center and the University of Minnesota, one of the authors of this paper (Gunderson) is conducting a research study to determine how effectively the K-8 "Wilderness & Land Ethic" curriculum influences students' and teachers' knowledge, attitudes and beliefs about wilderness. The specific wilderness education format evaluated in this study is the "Wilderness & Land Ethic" curriculum and teacher workshops. The "Wilderness & Land Ethic" curriculum (Arthur Carhart National Wilderness Training Center 1995) was developed for kindergarten through eighth grade (K-8) children. The curriculum introduces students to the value of wilderness and to appropriate wilderness behaviors.

Little is known about the effectiveness of the K-8 "Wilderness and Land Ethic" curriculum and teacher workshops. The study addresses the following research questions:

1) How does the "Wilderness and Land Ethic" curriculum influence students' and teachers' knowledge, attitudes and beliefs about wilderness?

2) How can the "Wilderness and Land Ethic" curriculum and teacher workshops be improved to better address knowledge, attitudes and beliefs about wilderness?

3) Applying the Model of Responsible Environmental Behavior, what conclusions can be drawn regarding the influence of the "Wilderness & Land Ethic" curriculum on knowledge, attitudes and beliefs about wilderness?

Theoretical Foundations

Due to the broad spectrum of ages and programs that fit within the confines of wilderness education, there are several learning theories involving cognition and behavior, as well as social psychology theories of persuasion, that have been and/or could be applied to wilderness education research: The Elaboration Likelihood Model (Petty and Cacioppo 1981, 1986), The Theory of Reasoned Action (Ajzen and Fishbein 1980), The Model of Reasoned Wilderness Behavior (Hanna 1995), Constructivist Theory (Dewey 1916; Piaget 1952; Vygotsky 1978) and The Model of Responsible Environmental Behavior (Hines and others 1986/87, Hungerford and Volk, 1990). The lead author of this study (Gunderson) proposes using the Environmental Behavior Model (Hungerford and Volk, 1990) as the primary theoretical foundation of the research and will apply its model, and its variables, to the process of wilderness education.

The ultimate goal of environmental education is the development of environmentally responsible and active citizens, and the Model of Responsible Environmental Behavior provides a model to achieve this goal. Responsible environmental behavior (REB) can be defined as ways people can help solve environmental problems. REB is the equivalent to other terms that appear in the environmental education literature: pro-ecological behavior, pro-environmental behavior, environmental action and environmental problem solving. The Model of Responsible Environmental Behavior emerged from a meta-analysis of behavior research literature in environmental education (Hines and others 1986/87).

Over the past two decades, environmental educators have become increasingly aware of the importance of influencing people to behave responsibly toward the environment. Interest in REB research has expanded to academic fields of education, psychology, sociology, engineering, political science, business, forestry and communications. The Responsible Environmental Behavior Model is based on numerous research studies. Its focus is to determine which factors can be shown to predict REB. Predictor variables are: locus of control, intentions to act, knowledge of issues, knowledge of action strategies, attitudes, personality factors and situational factors. Key variables have been organized on a horizontal plane into three categories: entry-level, ownership, and empowerment. Entry- level variables are good

predictors of behavior that appear to be related to responsible citizenship. Ownership variables are environmental issues that are very important at a personal level. Empowerment variables give people a sense that they can make changes and help resolve important issues.

If the goal of environmental education is the development of environmentally responsible and active citizens, the variables identified in *the Responsible Environmental Behavior Model* should be tested, using the "Wilderness and Land Ethic" curriculum as an evaluative study, to determine if the curriculum influences students' and teachers' knowledge, attitudes and beliefs about wilderness.

Summary of a Wilderness Education Research Program

In 1996, two studies were conducted to examine the effectiveness of the impact monster skit, a wilderness education program used primarily by the U.S. Forest Service and other federal wilderness management agencies. This section provides a summary of this research. For complete details of the studies, please refer to Hendricks and Watson (1999) and Hendricks (1999).

The impact monster skit, developed approximately two decades ago by Jim Bradley, is designed to introduce low-impact camping skills and to teach appropriate behavior in wilderness and other wildland areas. Although various versions of the skit have emerged over the years, in most cases an impact monster demonstrates inappropriate wilderness behavior such as harming wildlife, polluting streams, cutting limbs off of trees, hiking in sensitive areas, making a large fire, littering and damaging other resources. Appropriate behavior is then modeled (or the impact monster's behavior is corrected) by a wilderness ranger or wilderness user. A discussion of permanent and nonpermanent impacts usually accompanies the skit.

Most evaluations of the impact monster program have been informal assessments by wilderness educators of the program's effectiveness. One notable exception was a study conducted by Tracy (1995) that determined the skit improved wilderness knowledge of fifth grade students. The research program discussed hereinafter is believed to be the first comprehensive, formal evaluation of the program using multiple research methods and approaches.

Wilderness Educators Evaluation

The purpose of the first study completed as a portion of the research program was to examine wilderness educators' perceived effectiveness of the impact monster skit (see Hendricks and Watson 1999). Following informal discussions with wilderness educators and managers nationwide and a focus group session at the 1995 Wilderness Education Working Group Session in Salt Lake City, a survey was conducted with a mail-back questionnaire. Fifty-five of 83 subjects identified as being familiar with the impact monster program responded to the survey.

Key results of the study indicated that 80% of the subjects rated the program good to excellent as a tool for teaching wilderness education. The program was considered most effective for fourth, fifth, third and sixth grades audiences respectively. The most serous perceived problems with the skit were children being afraid of a gun, wilderness educators tiring of presenting the program and high school and students in grades 6-8 identifying with the impact monster. Other problems mentioned included difficulties with classroom management and behavior, a lack of funding for props and the purpose of the program being lost in the process of the skit because of its entertainment orientation. It was suggested that behavioral objectives for the skit could be developed to focus on leave-no-trace principles, a land ethic, recognition of impacts and wilderness knowledge. Suggestions for improving the skit included avoiding stereotyping and recognizing cultural differences, improving prop preparation and acquisition, emphasizing positive behavior, developing formal evaluation methods and maintaining flexibility in the presentation of the skit.

Quasi-Experimental Study

A second study was completed with 574 students in 24 first, third, and sixth grade classes on the California Central Coast adjacent to the Los Padres National Forest (see Hendricks 1999). The purpose of the study was to examine whether persuasive communication sources and messages and grade level effected low-impact camping behavioral intentions. The study employed a repeated measures analysis of variance using a pretest and post-test design. Message factors were based on the Elaboration Likelihood Model of persuasive communication, which focuses on peripheral and central routes to persuasion (Petty and Cacioppo 1981, 1986). The source factor had two levels of a positive message source—a good guy dressed as a typical wilderness hiker or as a ranger—and two levels of a negative message source—an impact monster dressed in brightly colored clothing or as a typical wilderness hiker. The message content was varied with a telling version of the skit and an asking version. The dependent variable was short-term, low-impact camping behavioral intentions. An illustration with 11 inappropriate behaviors and six appropriate behaviors was given to the subjects before and after the skit. Each time they were shown the illustration, the subjects were asked to indicate which things they would do the next time they went camping in a wilderness.

An analysis was conducted for the full repeated measures model, using an aggregate score of the behavioral intentions and a chi-square analysis of each of the 17 behavioral intentions, to determine differences in pretest and post-test scores. There was a significant difference in pre and post-test scores of behavioral intentions for the full model, and all levels of the message source, message content, and three grade levels. A significant interaction effect was present for the positive message source (wilderness hiker/ranger) and the pre and post test scores. The hiker was more effective than the ranger when considering this interaction. Furthermore, third and sixth grade levels influenced behavioral intentions more than first grade. Although not statistically significant ($p < .054$), the telling message had a greater difference in mean scores than the asking message for all

grade levels. The chi-square analysis was significant and the expected direction for 15 of the 17 behaviors. For example, washing dishes in a stream (an inappropriate behavior) was selected by 48.1% of the pretest subjects, but only 13.2% of the post-test subjects. Similarly, use of a stove (an appropriate behavior) increased from 59.9% to 79.1% between the pretests and post-tests.

The skit continues to be a popular wilderness education program that exposes children and adults to appropriate wilderness behavior. Many wilderness educators perceive it to be an effective wilderness education program; yet it is not without its problems and critics. It appears to influence short-term behavioral intentions, relying on peripheral cues of persuasive communication. Other persuasive communication variables, including additional sources, message recipients, message involvement, effects on longer-term behavioral intentions and the order of the positive and negative messages, need attention in further research. The skit can also be improved with more formal links to leave-no-trace principles, content changes, standardization of skits, improved funding, awareness of cultural differences and training of presenters in classroom management and behavior techniques.

Wilderness Education Direction for the Future: A Federal Perspective

To celebrate Earth Day on April 22, 1999, three high school English classes in a small, rural New Mexico town devoted primarily to oil and gas production were given Thoreau's quote, "In Wildness is the preservation of the world", and asked to write a short essay on whether they believed it. Fifty-seven students submitted essays. About 10% of the students were Hispanic, 15% Navajo, and the remainder were of Anglo origin, with the exception of one African American student. While this may not be a statistically valid sample of rural New Mexico, nor even of this high school student population, it is nonetheless interesting to note that of these 57, four students were ambivalent toward wilderness, one opposed the idea, and the remainder—over 90%—wrote variations of "wilderness is important to me." It is perhaps also telling that over one-third of the students didn't bother to write about it. However, one cannot assume that lack of interest indicates a corresponding lack of appreciation for wilderness: Failure rate in these classes averages 40%, and assignments are routinely ignored. Here's what Shannon, the only black student in his senior class had to say:

> Personally, I don't really appreciate the wilderness as much as I should. I mean, I think there should be laws protecting it. Because when it's gone, what do we have left? The reason why we don't respect the wilderness is that we don't know anything about how important it is to our society. A lot of young people like myself don't care because we think, " Well, there are other wildernesses out there." Also, most people find these things extremely boring because it does not have their interests. People and the government need to be educated more on the wilderness, and explain the dangers when it's gone.

Many federal employees of the four agencies entrusted with the stewardship of the National Wilderness Preservation System would agree with this student's statement, "People and the government need to be educated more on the wilderness." In preparation for the Sixth National Wilderness Conference in Santa Fe in 1994, registrants were asked to provide a prioritized list of the top ten wilderness issues that they believed should be addressed in the next ten years (Barns and Krumpe 1995). Of the 128 issues identified, the fifth most important issue was "LNT (Leave No Trace) training of the public." Even more important, however, was the issue ranked as the fourth most important," Educating nontraditional publics (including adversaries) to the complete range of wilderness values and ethics." Tied with LNT training for the fifth most important issue out of 128 was: "The lack of understanding or commitment by (those in the) agency hierarchy (to the wilderness ideal)." This last issue is particularly interesting in that concern for it has greatly increased in the 11 years since the First Wilderness Management Workshop in Moscow, Idaho.

This concern manifested itself in an outcome of the Santa Fe conference. Through a nominal group process in strategic planning groups, attendees generated a list of 49 actions needed to guide wilderness stewardship over the next decade (Barns 1997b). When the priorities of 424 participants were collated, the second most important action to be taken was, "Develop *and commit to* a coordinated national strategy to address nationwide wilderness education, including interagency and external organizations, the public, and the media" (emphasis added). Only slightly lower in importance (fifth and sixth, respectively) were subsets of this action: "Work with national environmental organizations to add wilderness education to grades kindergarten through twelve" and "identify strategies appropriate to diverse audiences (such as cultural, rural, urban, and nontraditional groups)". Variations on these recommended actions were formally adopted by the four agencies (Barns 1997a) in their Interagency Wilderness Strategic Plan of 1995.

A key to these aspects of wilderness education, as it is with any phase of wilderness management, is the understanding and support of the agency line officers who have the final word on how public lands are managed. Many lack even a fundamental appreciation of the wilderness resource and would not comprehend this statement from Crystal, a sophomore in the writing exercise outlined above:

> I believe there should be a part of land that is kept all natural. Some people believe that if we could make money off of it, then we should destroy it; but we have enough other land already destroyed, never to be natural again, that could be used for anything people want. Wilderness should be preserved to keep us from getting too involved in technology. Also, sometimes we all need a break to go spend time in nature, without technology. Therefore, wilderness should be preserved to also preserve humankind.

Examples of line officers' lack of comprehension or support for wilderness values abound. There is the line officer who, when confronted with a trespass route and

livestock development, suggested that the wilderness specialist write it up as the proposed action in an Environmental Assessment and prepare a finding of no significant impact. There is the executive management team of a federal wilderness-managing agency in New Mexico that, when deciding on a Strategic Plan to guide the state's priority programs for the next five years, purposefully omitted any mention of wilderness, even though one of the agency's most visited designated wildernesses is in that state. And there is the line officer who stated, "I don't know why we have some of these areas as wilderness. I mean, I can show you places that look just like that you can drive to." Certainly, there are also hopeful, enlightened words and actions from line officers. But, clearly, there is a need for wilderness education in the agencies. Wilderness education should be differentiated from wilderness training, which has to do more with the nuts and bolts of management. Wilderness education is the more philosophical "why" of wilderness.

The Arthur Carhart National Wilderness Training Center offers several line officer training courses, which include an educational component. But it is not known if attendance at these courses makes for difference in the actual management of the National Wilderness Preservation System. Perhaps line officers are being reached too late in their careers, after their concept of wilderness is already set. Perhaps employees should be trained in wilderness earlier in their careers, but that would necessitate the concurrence of their supervising line officers, some of whom believe that wilderness is not important.

Line officers, for the most part, are merely reacting to the world around them. As can be seen throughout this country, support for wilderness may be broad, but it is also shallow; whereas the opposition may be narrow, it is deep. Perhaps the most effective way to change the thinking of line officers is to change the thinking of the general public with regard to wilderness. This can be demoralizing if one gets caught up in the scale of the undertaking. The old adage "think globally, act locally" has been criticized for just that reason — it is often to daunting to consider the global good, and idealists give up in the face of that overwhelming need.

So, should those dedicated to wilderness preservation be content to think locally and act locally? Should agency wilderness education be modeled after the way childrens' wilderness education is currently conducted — piecemeal, and of a quality ranging from brilliant to mediocre?

Or is this incrementalism enough? Should wilderness preservationists be thinking — and acting — if not globally, at least nationally? Shouldn't there be a Unified National Wilderness Education Plan, that seeks to promote and enhance the preservation of wilderness for present and future generations by increasing awareness, understanding, appreciation and support of the National Wilderness Preservation System among the American people? And shouldn't this plan target not only wilderness visitors, but children — the wilderness advocates of the future? And not only children, but their parents — adults from diverse cultural, geographic and social backgrounds — nurturing wilderness advocates for today? And shouldn't the plan also target the important framers of those adults' opinions—the media—and target members of Congress who hold the power of life or death over the National Wilderness Preservation System?

Thoreau's sentiment, "In Wildness is the preservation of the world," must be embraced by agency personnel. Without that passion, can a Unified National Wilderness Education Plan succeed? Without such a comprehensive plan, will the National Wilderness Preservation System survive to the 22nd century? Here's what Ricardo, a high school sophomore in the writing exercise outlined above, had to say in response to those words by Thoreau:

> I believe mankind is headed down the wrong path. Except for a very few areas that are protected by law, we are destroying and taking advantage of this planet we live on. There are better ways to take care of our planet. We don't have to give up our way of life, but instead concentrate on how we can make our way of life without hurting our future generations. The things in this paper are easy to write down, but probably won't start to happen until it is too late or until we are on the verge of destroying ourselves. That's why I am glad we have wilderness protected by law, so at least in our future we might still have something to say: "This is how it used to be." I pray and hope I can educate myself and help others realize the best way of life isn't always the easy way, or having so many luxuries, which in turn bring about all our pollution and destroying of this planet. I am not saying we have to return to our Stone Age, but I am saying we must change. Without this planet, all of our advances and discoveries, and the legacy of mankind, will all add up to nothing.

Participant Comments

A combination of wilderness managers, university researchers and students, environmental educators and other wilderness advocates attended the session to discuss the primary challenges facing wilderness education research and what specific research topics in wilderness education should be studied. The following is a summary of the comments offered.

What Are the Primary Challenges Facing Wilderness Education Research?

- Making the abstract (love of wilderness) meaningful in a more concrete (personal) way.
- Teaching young people to think critically about ethical dilemmas in the outdoors.
- Teaching respect for the wilderness in culturally appropriate ways.
- Helping people think more about wilderness and ethics in multiple ways.
- Measuring the effectiveness (behavior change) over the long term. A need for a longitudinal study mechanism.
- Determining the right audience/target group to study. School-age children? Teachers? Adults? Stock users? Hikers? Nonwilderness users?
- Observing good or bad behavior and then determining if the individual/group did or did not benefit from wilderness education.
- Explaining differences between "wildlands" and wilderness.
- The need for more clearly defined objective(s) for wilderness education.

What Are Some Specific Research Topics For Study In Wilderness Education?

- Is actual experience in wilderness a predictor of long-term appreciation of wilderness?
- The effects of wilderness (or merely nature) experiences versus classroom education on behavioral attitudes towards wilderness.
- Which independent variable—environmental sensitivity or knowledge of environmental action strategies—is more in need of enhancement, and for which audiences, in order to increase responsible environmental behavior.
- Exploring the "disconnect" between attitudes and behavior (in the long view, it is the behavior that matters).
- Why do attitudes lead to behavior in the marketplace (as evidenced by consumer research), but not in wilderness (as evidenced in wilderness education research)?
- Would it be better to concentrate limited education time and budgets on adults (the actual users, voters, parents) who are currently using/impacting wilderness, rather than children, for better effectiveness?
- Quality of good presenters-what training they need. How can people with no environmental educational background become better educators and become more effective?
- A measure of the effectiveness of who delivers a wilderness education program.
- Methods of successfully reaching local adults, especially in rural areas, who have generations of experience creating unnecessary impacts on "their" public lands and are resistant to any kind of message from "the government."
- Regarding wilderness education in the schools, how do you accommodate children with various levels of disabilities?
- For school-age education—are there ways to effectively incorporate programs such as the "Wilderness & Land Ethic" curriculum into school curriculums? Teachers have so much required curriculum that they are reluctant or unable to include wilderness curriculum or add to their workload. Does the curriculum meet national and state educational guidelines?
- There is a need to examine the "fit" of wilderness education with other content (biology, environmental education, physical education)
- Measuring the effectiveness of interactive video tools or web-based sites that might alter pre-trip attitudes and understanding of wilderness.
- Should wilderness be "advertised" in the same way Dodge Caravans are?

Concluding Remarks

Wilderness managers have prioritized wilderness education as a strategy to increase wilderness knowledge for the public, agency and external organizations, politicians and media. A Unified Wilderness Education Plan could increase understanding, appreciation and support for wilderness. Despite the importance wilderness managers place on wilderness education, there is little research on wilderness education program effectiveness in changing levels of knowledge, attitudes and beliefs about wilderness.

At present the K-8 "Wilderness & Land Ethic" curriculum is being evaluated to determine its effectiveness to influence students' and teachers' knowledge, attitudes and beliefs about wilderness. If the goal of environmental education is to develop environmentally responsible and active citizens, then entry-level, ownership, and empowerment variables from the Model of Responsible Environmental Behavior should be tested using the "Wilderness & Land Ethic" curriculum.

Another wilderness education research program for school-age children on low-impact camping determined how persuasive communication sources and messages and grade level influence behavior intentions. Wilderness educators who evaluated the low-impact camping program felt that the program is an effective tool for teaching wilderness education.

Although wilderness education programs reach diverse audiences, the wilderness message needs to reach a much broader spectrum of the American public. Wilderness education research examples were provided in this session and participants offered additional suggestions to determine new directions and priorities for research. The overall goal and direction of wilderness education practices and research should influence knowledge, attitudes, beliefs and behaviors that will ensure the preservation of the National Wilderness Preservation System for present and future generations.

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Current Approaches to Norms Research

John L. Heywood

Abstract—The dialogue session was a continuation of a debate about norms and the application of normative standards to wilderness management that has taken place throughout the 1990s at national meetings and in the research literature. Researchers who have made significant contributions to the normative approach to wilderness recreation management presented three approaches to the norm problem. Doug Whittaker and Bo Shelby presented the structural norm approach, Robert Manning presented the evaluative standards and photo approach, and John Heywood presented the behavioral norm approach. Each presenter gave an overview of their approach and presented several resolutions concerning future research.

Wilderness is legally defined as a place where humans are visitors and the imprints of their actions are to be substantially unnoticeable. In addition, Wilderness is to provide outstanding opportunities for solitude and primitive and unconfined types of recreation. Other wild and primitive areas and rivers generally are subject to similar requirements. When recreational use of Wilderness, primitive areas and wild rivers results in environmental impacts, changes to natural conditions and perceptions of crowding, managers are faced with perplexing challenges to maintain or restore wild conditions, solitude and primitiveness. Early research on wilderness and primitive area users showed that they were sensitive to the environmental and social conditions found in wilderness and had definite preferences about wilderness conditions (Lucas 1964; Stankey 1973). An important contribution to wilderness management was made by Thomas Heberlein, Jerry Vaske and Bo Shelby when they began to translate users' preferences into standards that could be used as management objectives (Shelby & Heberlein 1986; Shelby & Vaske 1991; Shelby and others 1996). The theoretical basis for identifying users' standards was Jackson's (1966) Return Potential Model (RPM) of social norms. Consequently social norms became an important area of research that has contributed much to our understanding of desired wilderness conditions and recreation use.

Background

In the early 1990s, however, Roggenbuck and his colleagues questioned whether the structural norm approach adapted from Jackson's RPM was actually measuring norms (Roggenbuck and others 1991). Since then other researchers have attempted to refine the measurement of users' standards and norms (see special issues of Leisure Sciences, 18, 1 and 2 (1996) on Normative Perspectives on Outdoor Recreation, Parts I and 11; and Manning and others 1999; Heywood & Aas 1999: Donnelly and others in press) and have addressed theoretical issues of the meaning and definition of social norms (Heywood, 1996a, 1996b). A vigorous debate about normative theory, norm measurement, and the application of normative standards to management problems has taken place throughout the 1990s at national meetings and in the research literature.

The dialogue format as one component of the Wilderness Science Symposium seemed like an ideal means to continue the debate and discussion of social norms. Three approaches to the norm problem were identified that were linked to the work of particular researchers or groups of researchers. These were: 1) the structural norm approach based on an adaptation and expansion of Jackson's RPM as developed by Bo Shelby and Jerry Vaske and their colleagues; 2) an evaluative standards approach by Robert Manning and his colleagues that has addressed the various meanings of measurement terms and has introduced and developed a photo approach; and 3) a behavioral approach that has sought to clarify normative theory and develop measures of behavioral norms, sanctions, and behavior/condition links by John Heywood. Individuals from each of the three approaches were contacted and asked to participate in the dialogue session. Doug Whittaker and Bo Shelby agreed to represent the structural norms approach, Robert Manning agreed to represent the evaluative standards approach, and John Heywood agreed to represent the behavioral approach. Each representative was asked to develop an abstract based on one to several resolutions or issues that captured an important component of their approach and the direction research should be taking in the future. The abstract and resolutions/issues were presented in the dialogue session and provided the basis for discussion among the representatives and participants.

The dialogue session was opened and moderated by Michael Patterson. Mike introduced the topic, giving information similar to the introduction above, and introduced the representatives for each of the normative approaches. Doug Whitakker and Bo Shelby started the session with an overview of the structural approach and their issues/resolutions. Bob Manning followed with a presentation on the evaluative standards approach and his four resolutions, and John Heywood concluded the session with a presentation on his behavioral approach and resolutions.

The Structural Norms Approach: Doug Whitakker and Bo Shelby

A fundamental task in wilderness management is defining natural resource health and experiential quality through

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standards that establish limits of acceptable behavior or conditions. The ideas developed within the "structural norm tradition" are useful for measuring and organizing information about evaluations of behavior and conditions. Structural norm theory was initially developed to explore behavior evaluations, but natural resource applications have extended some concepts and methods. Some of these extensions have led to debate over norm definitions and applications. This presentation reviews the approach and responds to two issues in the debate using examples from studies in wilderness.

The Structural Approach

As applied in natural resources, this approach developed both from Jackson's RPM and Hall's (1968) work on proximics—the distance between people in different social situations. The focus in either case was evaluating behavior along a continuum—the acceptability of more or less of a certain behavior; the acceptability of being closer or further away in a social situation. The most common application in wilderness has focused on encounter norms, a condition evaluation that links to proximics, but focuses on how many contacts people should have for a given situation, rather than on how far apart people should be during those contacts. The approach views norms as evaluative mental states held by an individual toward an object. Structural norm techniques have people evaluate behavior (or conditions) on acceptability scales to define their "personal norms." Taken together in aggregate, personal norms that show shared agreement within a group are said to define "social norms."

Norms differ from attitudes (which are also evaluative mental states) in their injunctive focus. Norms are about degrees of should/should not (what is acceptable/unacceptable), while attitudes are about degrees of good/bad. In addition, norms are thought to be communicated within groups through sanctions, which are often internalized as a sense of obligation. Obligation, sanctions, and shared agreement about evaluations are thus central to the norm concept, although only the latter has received much measurement attention with the structural approach.

Issue 1: The Concept of a Normative Continuum—Critics of the structural norm approach have focused on the need to measure sanctions and obligation. They have advanced the notion of a continuum of regular behaviors (from social conventions to emerging norms to norms), and suggest these two dimensions define which label should apply. We support the notion of a continuum, and are impressed with recent attempts to measure obligation and sanctions. However, we believe there are several dimensions that measure "normative strength," including obligation, sanctions, and structural tradition measures such as intensity, shared agreement, and prevalence. More importantly, we think all of these characteristics should be treated as variables rather than establishing thresholds, which define norm existence. The question is whether an evaluation is more or less normative, not whether it exists or not.

Resolution 1: Future research should measure a range of characteristics that may indicate its norm strength along a normative continuum.

Issue 2: Extensions from Behavior to Conditions, and from the Individual to the Collective—Structural norm applications in natural resources have extended the focus from behavior evaluations to condition evaluations. A simple case suggests that if there is a norm against building a fire ring of certain size in a wilderness area, there can be a norm against having fire rings of that size in the same place. Critics recognize utility in this extension, but suggest it is theoretically flawed since you can't measure obligation of a wilderness area, nor can you sanction it. However, a broader view that considers collective and institutional behavior offers an alternative conceptualization.

In many natural resource settings, problems are caused by collective behavior. Management standards are set to define how much impact is too much, and thus define when collective behavior should be constrained. Structural norm researchers can help in this process by exploring the acceptability of collective impacts among individuals and groups. These are normative because visitors report how conditions should be (whether they are acceptable or unacceptable). With structural norm methods, visitors specify their personal condition norms, which are aggregated to empirically define social condition norms, which managers can use to establish management standards. These standards, in turn, define when institutional actions are needed to constrain the collective behavior that is causing the unacceptable impact.

Sanctions can be conceptually understood within this framework. Individuals with personal norms at dissonance with existing conditions may apply sanctions toward the managing agency rather than toward fellow users who are collectively causing the problem. Similarly, staff and decision-makers within the agency may very well internalize such sanctions (feeling guilt and uneasiness) if their actions fail to maintain quality conditions.

Resolution 2: Future work should distinguish between behavior and condition norms which do have theoretical differences.

Resolution 3: Future work should attempt to measure evidence of alternative types of sanctions or obligations, particularly those directed toward agencies or internalized by agencies.

The Evaluative Standards Approach: Robert Manning

Contemporary approaches to carrying capacity—and outdoor recreation management more broadly—focus on indicators and standards of quality. Indicators of quality are measurable, manageable variables that define the quality of the recreation experience. Standards of quality define the minimum acceptable condition of indicator variables. Carrying capacity and outdoor recreation are managed by monitoring indicators of quality and taking management actions to ensure that standards of quality are maintained. Normative theory and related empirical methods have been used to help managers with the difficult task of formulating standards of quality.

"Norms" or "Evaluative Standards"?—A variety of empirical methods have been derived and adapted from normative theory and applied to outdoor recreation

(Heberlein 1977; Shelby & Heberlein 1986; Vaske and others 1986; Manning and others 1996). Generally, these methods ask respondents to judge the acceptability of a range of impacts, such as crowding, that can be caused by increasing levels of recreation use. Resulting "personal norms" are aggregated to derive "social norms." Calculation of social norms is designed to provide a strong, quantitative basis for formulating standards of quality.

However, the terms personal norms and social norms have been subject to increasing scrutiny in the outdoor recreation literature (Roggenbuck and others 1991; Shelby & Vaske 1991; Noe 1992; Heywood 1993a; Heywood 1993b; Heywood 1996a; Heywood 1996b; McDonald 1996; Shelby and others 1996), As traditionally defined in sociology, norms address behaviors that are based on a sense of obligation and have social sanctions associated with them to help ensure broad compliance (Homans 1950; Blake & Davis 1964; Cancian 1975; Rossi & Berk 1985; Biddle 1986). In other words, they are strongly prescriptive. Recreation norms may not fully meet these definitional criteria in that they generally focus on conditions rather than behaviors, they do not necessarily involve a sense of obligation on the part of the respondent, and there may be no form of sanctions to reward or punish associated behavior. Moreover, as described later in this paper, measurement of recreation norms has not included explicit consideration of the tradeoffs associated with judgments of acceptability. That is, judgments of acceptability describe how increasing impacts of recreation may affect the recreation experience, but do not necessarily indicate how the recreation experience should be managed. Therefore, recreation norms may be less prescriptive than norms as they are traditionally defined and measured. To the extent that these differences and limitations are valid, use of the term norms may misrepresent or overstate the character of such studies and resulting data. This suggests that alternative terminology—such as personal evaluative standards" and "social evaluative standards"—might be developed and applied to current studies designed to help formulate standards of quality. Such terminology avoids the implications associated with the term norms, and reflects the more purely evaluative nature of such judgments. Alternative terminology is not intended to diminish the value and usefulness of information derived from empirical studies of standards of quality. However, it may be a move accurate description of such studies and resulting data.

Resolution 1: Findings from current studies designed to help formulate standards of quality might best be termed personal and social evaluative standards rather than personal and social norms.

Implications of Alternative Measurement Approaches—Experimentation within studies designed to help formulate standards of quality has led to development and application of several empirical methods. For example, questions can be asked in a close-ended "long" or "repetitive item" format, or in an open-ended format designed to reduce respondent burden. Moreover, information on the range of impacts under study can be described to respondents through a narrative and numerical format, or can be represented visually through photographs. Finally, alternative evaluative dimensions, such as preference, acceptability, and tolerance, have each been used to rate the impacts under study.

Study findings suggest that the methods used to measure evaluative standards can influence resulting data (Manning and others 1999). For example, the open-ended question format may result in lower evaluative standards than the close-ended format, especially when visual measurement approaches are used. Visual measurement approaches may result in higher evaluative standards than narrative/numerical approaches, especially in relatively high use contexts. Alternative evaluative dimensions can result in evaluative standards that range from a low associated with preference to a high associated with tolerance. None of the measurement approaches described above may be more valid than any others, but researchers and managers should be conscious of these measurement effects and exercise appropriate care and caution in interpreting and applying study findings.

Resolution 2: Researchers and managers should exercise appropriate care and caution in selecting alternative measurement approaches for evaluative standards, and interpreting and applying resulting study findings.

Tradeoffs Associated With Judgments of Acceptability—As discussed above, norms traditionally have a strong prescriptive meaning; that is, they describe what "ought" to be. This suggests that measurement of norms, or evaluative standards, should adopt prescriptive wording and related response scales. The potential importance of this issue is magnified by consideration of the tradeoffs implicit in prescriptive questions. For example, current studies of evaluative standards ask respondents to judge the acceptability of a range of recreation-related impacts. However, these judgments are typically rendered without explicit consideration of the tradeoffs, necessarily associated with such judgments. If respondents report being relatively intolerant of recreation-related impacts such as crowding, then visitor use levels and public access may have to be restricted. If respondents report being relatively tolerant of such impacts, then public access may not have to be restricted. Initial research indicates that when respondents are made more explicitly aware of the tradeoffs between the level of impacts judged acceptable and potential restrictions on visitor use levels, evaluative standards are substantially higher than when such evaluative standards are measured in isolation (Manning and others 1999). Explicit introduction of the tradeoff's associated with judgments of acceptability is more in keeping with the prescriptive spirit of norms and evaluative standards, and may offer more realistic guidance to management agencies that formulate standards of quality.

Resolution 3: Measurement of evaluative standards should include explicit consideration of the tradeoffs associated with judgments about the acceptability of recreation-related impacts.

Alternative Theoretical and Methodological Approaches—Research on evaluative standards in outdoor recreation has been based primarily on norm theory and methods as developed in sociology and as explicated by Jackson (1965). Studies derived from this approach have been designed to provide a strong, quantitative basis for formulating standards of quality. However, other conceptual and empirical approaches to measuring evaluative

standards should be explored. The theoretical and methodological issues described above suggest strengths and weaknesses of the normative approach, and indicate ways in which other approaches may be especially useful (Mac Gumman & Toda 1969; Prudyck & Rubinfeld 1995). For example, the issue of tradeoffs between the acceptability of impacts and the desire to maintain reasonable, convenient access to outdoor recreation resources suggests that a tradeoffs based economic theoretical framework such as indifference curve analysis may be useful. Indifference curve analysis asks respondents to express their preferences for alternative combinations of two goods such as lack of crowding and accessibility to parks and related areas. Other theoretical frameworks and associated empirical techniques arising out of multiple academic disciplines should be explored as a supplement to norm theory and methods.

Resolution 4: Alternative theoretical and methodological approaches to measuring evaluative standards should be explored as a supplement to norm theory and related empirical techniques.

The Behavioral Approach: John Heywood

The importance of norms is their applicability to wilderness use and management. Norms are standards that can be used by managers to develop management objectives and prescriptions. In doing so managers need to understand that norms are of two different types (Cialdini and others 1990). One type is descriptive norms that define what is normal or typical. The other type is injunctive norms that define how one ought to behave. For example, low impact standards for wilderness and primitive areas could be considered as both types of norm. The descriptive norm would depict the conditions found as being consistent or not consistent with low impact standards. The injunctive norm would characterize the behaviors of users as being consistent or not consistent with an obligation to follow low impact methods and standards. The injunctive norm is a more powerful concept for management purposes because it provides a basis for educating, guiding, or directing users towards appropriate behaviors. Considering the low impact example, the descriptive norm is more likely to be consistent with low impact standards when the injunctive norm is operative (Cialdini and others 1990).

In the behavioral approach normative behavior is viewed as one end of a continuum of regular behaviors where behavioral regularities may begin as social conventions, which may become increasingly obligatory as emerging norms that eventually become normative obligations (Heywood 1996a). Behavioral norms are defined as prescriptive obligations (something that should never be done) or proscriptive obligations (something that should always be done) that are internalized and enforced through sanctions. The measures developed for the behavioral approach use the word obligation in the question and the normative term should in the response scale (Heywood & Aas 1999). When norm measures use unambiguous normative terms there is a clear logical connection between theory, measurement, and application.

Resolution 1: When measuring social norms, normative terms and concepts like obligation, should, ought, and must, should be used in questions and response scales.

A second critical norm concept is sanction. Norms are a powerful social concept because they provide standards that are more than simply collective preferences and opinions. The power of norms is in their sense of social obligation and that there is a benefit or cost for compliance or non- compliance through sanctions (Heywood & Aas 1999). Sanctions are the rewards or punishments for correct or incorrect behaviors. For norms to have any effect or influence on a person's behavior they must be internalized. Consequently, behavior is guided by internal sanctions, i.e., the anticipations or feelings of anxiety, guilt, embarrassment for failure to comply with the norm, or the anticipations or feelings of pride, comfort, acceptance for compliance with the norm. The norm measures in the behavioral approach use semantic differential scales to tap internal sanctions (Heywood & Aas 1999). For example, the respondent is asked whether they would feel uneasy or comfortable, embarrassed or admired, ashamed or proud, guilty or guiltless for either complying or not complying with the obligation. Sanctions can also be external and as such are part of the on-going process of socialization. External sanctions can be informal, like a smile or a frown, and formal, like a reward or a fine. Other users would apply informal sanctions, while managers would apply formal sanctions. Some interesting attempts have been made to measure external sanctions, but more needs to be done to empirically validate this concept.

Resolution 2: We need to test and refine measures of internal sanctions and develop and validate measures of external informal and formal sanctions.

A person's behavior may be observed by others or can be inferred from the artifacts or evidence left behind. Consequently a person's behavior can influence social and environmental conditions whether they are present or not. For example, I may come into contact with other wilderness users on trails and at campsites (social conditions), or I may see evidence, e.g., fire rings, braided trails, of other users' past behaviors (environmental conditions). There is an assumed link between the behavior and the social or environmental condition that results, but this link has not been put to rigorous empirical test.

Resolution 3: We need to empirically test the link between behavioral norms, and social and environmental condition norms.

Conclusion

Normative research in wilderness and outdoor recreation has made much progress over the past ten years. Normative theory in the social sciences has been explored in depth and its relevance to wilderness recreation and management has been clarified and expanded. Several normative models have been used and continue to be refined and tested. New measurement techniques—alternative evaluative dimensions, the photo approach and behavioral approach—have been developed as well as refinements to the structural approach—norm prevalence. Progress in normative research has been made because researchers have explored different components of normative theory and have vigorously debated new approaches and techniques. The issues that have been raised have not been resolved and the debate will very likely continue.

A continuing debate about the application of different normative models to wilderness recreation and management may frustrate and perplex wilderness managers. This may be an unfortunate by product of the debate, but the researchers intentions are ultimately to provide managers with normative information that is theoretically and scientifically valid as well as being applicable to wilderness issues and management problems. A scientific, scholarly approach to normative research is based on peer review and acceptance of innovations and research findings that are incremental and cumulative. While such an approach may be messy, it is the best way we know of to develop reliable and valid knowledge that is applicable to wilderness recreation and management.

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Wilderness Party Size Regulations: Implications for Management and a Decisionmaking Framework

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Abstract—Arriving at appropriate limits on the size of groups in wilderness remains a difficult and often controversial management challenge. This paper presents a review of the state of knowledge regarding group size from an ecological impact and visitor experience standpoint, a survey of wilderness managers regarding the current status of group size regulations and a proposed management decisionmaking framework for group size.

Almost every wilderness visitor enjoys the outdoors in a group of some size—the vast majority of visitors do not travel solo. Therefore, management decisions about limiting group size can affect many public land constituents and enthusiasts.

Limiting party size is an established and accepted visitor management technique used in wilderness. Current trends suggest that more managers are adopting party size restrictions and that the maximum allowable group size is getting smaller. In one of the first surveys of wilderness managers, Fish and Bury (1981) found that 46% of all Forest Service and 43% of all National Park Service wilderness managers had limited maximum group size. Washburne and Cole (1983) found that 48% of all wilderness managers had placed a limit on group size and that the percentage of Forest Service wilderness areas with such limits had increased to 58%. Marion and others (1993) surveyed National Park Service wilderness and backcountry managers in the early 1990s and reported that 62% required groups to limit their size.

Initially, group size limits were established to limit the social and ecological impacts resulting from a few very large groups. These large groups (of 50 or more visitors, for example) were typically not common, but also not uncommon in some wilderness areas. Fish and Bury (1981) reported a typical group size limit of 20 people plus 50 pack animals. Washburne and Cole (1983) found limits ranging from 5 to 60 persons with a median of 15; the most common limit was 25. Lime (1972) reported that the group size limit in the Boundary Waters Canoe Area Wilderness (BWCAW) in 1971 was 15 people per party; he also speculated about what types of visitors would be most affected if group size limits were reduced to 12, 10 or even 8. Now, some 25 years later, allowable size has been lowered to nine in the BWCAW, with a controversial proposal to further reduce maximum size down to seven persons. Cole and others (1987) have noted that party size limits larger than about 10 would likely have little social or ecological consequence. Given this and the apparent perception that larger parties have disproportionately high impacts, managers throughout the National Wilderness Preservation System (NWPS) have moved toward more stringent group size restrictions.

To begin to answer these questions, we initiated this project with several goals: 1) to examine the current literature on the ecological and social consequences of group size limits; 2) to conduct an examination of the current management status of group size limits in the National Wilderness Preservation System; and 3) to review the possible management options and visitor practices in order to develop a decisionmaking framework for adopting group size limits. Minimizing ecological and social impacts, while of fundamental importance, is just one goal of wilderness management. Optimizing this goal may conflict with other important goals, such as pursuing equity in decisions about access and avoiding the exclusion of organized groups that provide important societal benefits. We believe that careful, conscious and explicit decisions about how best to compromise between these alternative goals and additional research are critical to the process of setting defensible use limits.

The Influence of Group Size on Ecological Impacts

There have been very few empirical studies of the influence of group size on either the areal extent or intensity of ecological impact. The only study we found to directly manipulate group size and measure a response was a study of per capita firewood consumption. Davilla (1979) found that Sierra Club groups of 20-25 people burned less than one-half the firewood per person per fire than other groups of about

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four visitors. A Sierra Club group of 41 burned only one-half as much firewood per person as a group of 20-25. The large groups burned more total wood than small groups; they just burned less per capita per fire. However, since large groups are more likely to have more fires than small groups (Christensen and Cole, this volume), actual per capita firewood consumption might not be less in larger groups. Therefore, this is hardly a compelling argument in favor of fewer large groups rather than more small groups.

The next category of research results might be termed suggestive. In these studies, the effects of different group sizes were not directly compared, but research findings suggest why either larger or smaller groups might be more damaging in different situations. In a study of nordic skiing impacts on elk and moose, Ferguson and Keith (1982) found that animals were startled at the passage of the first skier but it was irrelevant how many additional skiers passed by thereafter. This suggests that a few large groups would have less impact than many small groups, since there would be fewer skier-wildlife interactions overall. Wildlife disturbance may be the primary impact for which a few large groups are less disturbing than more small groups.

The research generalization with the most important implications for group size is the curvilinear relationship between use and amount of impact, first described as an important principle by Cole (1981, 1987) in syntheses of research findings that began with the work of Frissell and Duncan (1965). This relationship indicates that differences in amount of use can cause great differences in amount of impact to vegetation and soils, but only when use and impact levels are low. Where use and pre-existing impact levels are high, even large differences in amount of use have little effect on amount of impact. The primary implication of this finding to group size is that the adverse effects of larger groups can increase as amount of use and prior impact decrease– but only in certain circumstances. In relatively undisturbed places, intense, concentrated use by a large group can cause substantial impact, while a small group exhibiting the same behavior over a similar square area might cause little significant impact to the soil and plant communities. There are, however, many variables that can alter the above scenario, such as a group's level of minimum-impact behavior, use of dispersal strategies while traveling and in camp, relative durability of the vegetation and soils of campsites, etc.

Numerous studies have also found that horses have more potential than hikers to cause both accelerated erosion (DeLuca and others 1998) and vegetation damage (Cole and Spildie 1998). This suggests that size limits are particularly important for groups with horses and mules, particularly in less-disturbed portions of wilderness.

Finally, one can draw some common-sense conclusions about group size effects. The primary such observation– based particularly on the curvilinear use-impact relationship–is that large groups are not likely to increase either the area or magnitude of impact if the already impacted places where they walk and camp are large enough to accommodate them. Conversely, large groups will have much more impact than numerous small groups if already impacted sites are not large enough to accommodate large groups.

These research results and common-sense conclusions, particularly the use-impact relationship, suggest several generalizations. First, large groups may tend to cause more impact than small groups, and few large groups are more likely to cause more soil and vegetation impact than many small groups. However, this generalization is most valid in remote, lightly impacted portions of wilderness under certain circumstances, as described previously. In places with impacted sites large or numerous enough to accommodate a large group within the already impacted area, group size limits are considerably less useful.

Second, group size limits decrease in value as the size limit increases. The common group size limits, in the range of 15 to 25 people or stock, is likely to have little effect on ecological impacts. If these groups do not employ strict minimum-impact techniques, they will need to find—or will create—very large impacted areas while camping and will cause observable impact in trail-less areas while hiking. This is particularly true when groups travel with horses and mules. Horses cause more and different impact than hikers, so if the goal is to reduce ecological impact, group size limits should be lower for horse groups than hiking groups, and horses should be counted as if they were group members.

It should be stressed, however, that not all groups are equal. We are convinced that a large group of conscientious, experienced people, even with horses, can cause little impact, even less than a small group of people who are unconcerned or unknowledgeable (although this is difficult to test experimentally). Specifically, large groups can mitigate the effects of their size on soils and vegetation by 1) breaking into small groups to travel and camp, 2) camping in areas with large impacted sites and confining their activities to already impacted places, and 3) meeting infrequently as a large group and only on a durable site, such as a large rock.

The Influence of Large Groups on Wilderness Experiences

Considerable research has examined the impact of large groups upon visitor experiences in wilderness. Wilderness visitors generally say that encountering large groups reduces the feeling of wilderness. Stankey (1973 and 1980) and Towler (1977) asked visitors to six different western wilderness or backcountry areas whether seeing large groups reduce the feelings that one is in wilderness, and more than two-thirds said it did. An exception to this finding was the Boundary Waters Canoe Area Wilderness, where 54% agreed with the statement.

Support for Party Size Limits

Today there is generally high support for party size limits, but there is considerable variation across time of study and type of wilderness use group. As time has passed, more and more wilderness areas have adopted group size restrictions, and with these limits has come greater support for them. Stankey (1973) first measured wilderness visitors' support for party size limits and found that 62% of canoeists in the Boundary Waters Canoe Area Wilderness and about 70% of Bridger Wilderness visitors supported such limits.

About 75% of hikers in wilderness today support group size limits. For example, 76% of Desolation Wilderness

visitors, 79% of John Muir hikers, 85% of Sequoia-Kings Canyon hikers, and 71% of overnight hikers of the Lewis Fork and Little Wilson Creek Wildernesses indicated support for limits (Cole and others 1995; Roggenbuck and others 1994; Watson and others 1993).

Some have speculated that the reason most wilderness visitors generally support group size limits is that they bear none of the costs associated with this regulation (Cole 1995). Since most wilderness user groups include two, three, or four persons and most established size limits are much higher, these limits leave the majority of visitors unaffected.

Are Large Groups a Problem in Wilderness?

In those wildernesses where visitors have been queried, only about 20% to 30% say seeing large groups was at least a slight problem and very few say it substantially detracted from the experience. For example, 19% and 23% of day and overnight visitors at Three Sisters, Mt. Jefferson, and Mt. Washington wilderness areas, respectively, reported that seeing large groups was a problem (Cronn and others 1992). In the Great Smoky Mountains backcountry, 25% said the size of groups they encountered detracted from their experience. However, in another study in the Smokies, only 1% of backcountry visitors said that the size of hiking groups met along the trails greatly detracted from or ruined their experience. The large group issue ranked last on a list of 32 potential experience detractors (Renfro and others 1990). In the Teton Wilderness, 29% reported that large groups lowered the quality of their experience, but 12% said such groups added to their enjoyment (Grayson 1990).

In a 1971 study of use and users at Superstition Wilderness in Arizona, Lewis found a more serious party size problem. About 69% of all respondents noticed very large groups. About 28% found this annoying, and 22% said it seriously interfered with their enjoyment. Roggenbuck and others (1979) reported that the number of Linville Gorge, Shining Rock, and Joyce Kilmer/Slickrock Wilderness visitors who felt that encountering large groups was a problem equaled 35%, 47%, and 33%, respectively. By 1990, the percentage of Shining Rock visitors who felt that meeting large groups was a problem dropped to 41% (Roggenbuck and Stubbs 1991). Lime (1991) found that 33% of Boundary Waters Canoe Area Wilderness visitors felt that encountering large groups was a problem on their trip.

Another way to assess the severity of the "large group problem" on wilderness experiences is to determine how it ranks against lists of other potential problems. These studies have generally found group size to be among the lowest ranked problems. For example, Hall and Shelby (1994) found that Eagle Cap Wilderness visitors ranked "large groups seen" as 17th on their list of 19 impacts to experience quality. Cronn and others (1992) reported that encountering large groups ranked 7th to 10th of 16 possible impacts to experiences in Three Sisters, Mt. Jefferson, and Mt. Washington Wildernesses. Roggenbuck and others (1993) found that visitors to Cohutta, Caney Creek, Upland Island, and Rattlesnake Wilderness ranked the number of large groups seen as 12th, 15th, 12th, and 12th in severity out of 19 social and ecological influences on the quality of experiences (in this study, the influences could be positive or negative.). Roggenbuck and others (1982) reported the top ten perceived problems out of 42 listed for Linville Gorge, Shining Rock, and Joyce Kilmer/Slickrock, and encountering excessively large groups was not on the list of top 10 problems in any area.

Visitors of two wilderness areas in the high country at Mount Rogers National Recreation Area in Virginia differed in their evaluation of people seen in large groups by their own group type. For day hikers, backpackers, horseback riders, and hunters, the problem was ranked 16th, 14th, 28th, and 16th out of 36 potential problems listed on the survey (Roggenbuck and others 1994). Watson and others (1993) asked hikers and stock users at John Muir, Sequoia-Kings Canyon, and the Charles C. Deam Wildernesses to evaluate the severity of 23 problems, including seeing too many large groups. The group size problem tied for 13th, 12th, and 11th in ranking by hikers to the three areas, respectively. The stock users rated all problems as less serious, but they ranked too many large groups as 9th, 6th, and 9th in importance among their overall problem lists. Finally, about 16% of backpackers in the Great Smokey National Park indicated that the size of horse groups met along trails greatly detracted from or ruined their experience. These encounters ranked 3rd in importance out of 32 listed potential problems, indicating that large horse groups may be a much greater visitor experience impact in the Smokies than at other wilderness/backcountry studied (Renfro and others 1979).

Apparent Benefits and Costs of Party Size Limits to Wilderness Experiences

From the standpoint of impact on experiences, we believe that the current group size limits in place in most areas do have some benefits for protecting wilderness experiences. Seeing very large groups, for example, more than 20 people in a group, does bother many wilderness visitors. Such groups once existed in wilderness, although they were always a minority. Now, in part because of group size limits, they are very rare. But research also shows that encountering many other use, user, and impact variables in wilderness is more bothersome that group size issues. Also, we are not at all sure that seeing people in one large group has a more negative impact on experiences than seeing the same number of people in several small parties. Stankey (1973) did report such a negative effect of large groups in his historic study of the visitors at the Boundary Waters Canoe Area Wilderness and other western wilderness/backcountry areas. However, in that study, Stankey compared an encounter with a hypothetical group of 30 or more persons to seeing 10 groups of three people. But few of his respondents had encountered groups of this size in the wilderness; few such large groups existed. In addition, humans are not very adept at judging their response to hypothetical situations. For example, Manning and Ciali (1980) studied the relationship between hypothetical encounters with varying numbers of other recreationists and levels of satisfaction and found a drop in satisfaction as the number of encounters increased. However, when they assessed the same relationship between *actual* encounters and satisfaction, ratings of satisfaction stayed about the same across all the levels of density.

Current Status in Management

In order to understand the role that group size limits are currently playing in management of the NWPS, we surveyed wilderness managers in an effort to answer the following questions:

1) What is the percentage of all wilderness areas in the National Wilderness Preservation System that currently have group size limits, and what is the maximum allowable size?

2) What justifications do managers give for their group size limits?

3) Do wilderness managers have plans to alter their group size regulations, and if so, why and how?

Methods

A questionnaire was mailed to the managers of all 624 areas in the NWPS. A few wildernesses are managed by more than one agency; in these cases, we mailed each agency manager a survey. Approximately one month after the initial mailing, we sent nonrespondents a second survey and again urged them to respond. Through this procedure, we obtained an overall response rate of 81%, with a range of 75% for the U.S. Forest Service to 96% for the U.S. Fish & Wildlife Service.

Results

Maximum Allowable Group Size—Overall, about 52% of wilderness areas have established some type of group size limit (table 1). This varies greatly by agency, however. Only 11% and 17% of the Fish and Wildlife Service and the Bureau of Land Management areas, respectively, limit group size. About 68% and 73% of National Park Service and U.S. Forest Service areas, respectively, do so. Only 10 areas (1.9%) are closed or inaccessible, and eight of these are managed by the Fish & Wildlife Service. These differences likely reflect the differing recreational use levels and management philosophy/objectives of the four agencies.

Those areas with a group size limit on people (201 wildernesses) vary greatly in the specific number allowed (table 2). Responses ranged from 6 to 60, with a median of 12 and a mode of 10. Horse and packstock limits (108 wildernesses) varied almost as much, ranging from 5 to 35, with a median of 15 and a mode of 25. Heartbeat limits (57 wildernesses), a maximum allowed combination of people, horses, and sometimes dogs did not vary quite as greatly, ranging from 8 to 25, with a median of 15 and a mode of 25.

The four wilderness agencies show little difference in their maximum allowable group size for people, but do differ considerably in their prescriptions for horses (table 2). The Bureau of Land Management and the U.S. Forest Service have median group size limits for horses at 15 and 25, respectively, with the limit for the National Park Service at 11 and the only response from Fish & Wildlife Service at 10.

Only 18 areas, about 7% of areas with size limits, put separate limits on outdoor experience or educational groups. Although the sample size is small, the median of 12 people per group for educational groups is the same as that for groups overall.

Reasons for Group Size Limits—Respondents were presented with seven reasons for establishing group size limits. These were environmental impact, conflict between groups, conflict within groups, facility/site constraints, overall high use of the area, public complaints/pressure and consistency with neighboring wilderness areas. Area managers could check as many of these reasons as they desired, and there was opportunity to provide open-ended responses. Because of this, the percent of reasons listed in table 3 will total more than 100%.

Not surprisingly, environmental impact was the most frequently listed reason for establishing group size limits. About 81% of all area managers listed this reason. Quite surprisingly, the second most frequently selected reason, at 50%, was "to be consistent with neighboring wilderness areas." About 40% of all area managers cited "conflict between groups," "facility/site constraints" (that is, size of parking lot at trailhead), and "overall high use of area." Managers seemed to most frequently base their decisions on their own perceptions of resource or social impacts; only 24% said that "public complaints/pressure" was a reason for their group size limit. Finally, less than 6% (14 areas) of all respondents said their limit was based on conflicts *within* groups. In one sense, this is not surprising, since neither managers nor researchers have focused on within-group dynamics. On the other hand, we know that such dynamics profoundly affect the experiences of all groups in wilderness, especially the learning and growth outcomes of educational groups. Thus, managers may be unknowingly affecting experiences in wilderness in profound ways, for better or for worse, with their group size limits.

Plans to Change Group Size Limits—Over 77 percent of wilderness areas do not plan to make any revisions to their

Table 1—Wilderness area group size limits by management agency.[1]

Agency	No limits		Limits—same		Limits—different		Closed		Total
	N	%	N	%	N	%	N	%	N
BLM	99	82.5	13	10.8	7	5.8	1	0.8	120
USFS	82	27.4	209	69.9	8	2.7	0	0.0	299
USF&WS	52	77.6	5	7.5	2	3.0	8	11.9	67
NPS	11	28.9	20	52.6	6	15.8	1	2.6	38
Total	244	46.6	247	47.1	23	4.4	10	1.9	524

[1]It is possible for the area to have no group size limits (No Limits), to have the same limits for all users (Limits—Same), to have different limits for different user types (Limits—Different), or to be closed or inaccessible to the public (Closed).

Table 2—Breakdown of wilderness area group size limits for people, horses and/or packstock, and heartbeats by agency.

Agency	Number of people			Number of horses and/or packstock			Number of heartbeats[1]		
	N	Median	Mode	N	Median	Mode	N	Median	Mode
BLM	12	15	15	10	25	25	0		
USFS	166	12	10	85	15	15	56	15	25
USF&WS	5	15	15	1	—	10	0		
NPS	18	12	12	12	11	5,8,12, 15,20	1		16
Total	201	12	10	108	15	25	57	15	25

[1]Number of Heartbeats is often applied to groups with packstock as a count of the total group size, horses and humans. (Note: blanks indicate no or insufficient data to calculate a number.)

Table 3—Reasons for establishing group size limits by agency.[1]

Agency	N	Environ. impact		Conflict between groups		Conflict within groups		Facility/ site constraint		Overall high use of area		Public complaint/ pressure		To be consistent with neighbors	
		n	%	n	%	n	%	n	%	n	%	n	%	N	%
BLM	19	10	53	5	26	2	10	2	11	3	16	1	5	12	63
USFS	202	167	83	98	49	9	5	82	40	91	45	48	24	111	55
USF&WS	6	5	83	3	50	0	0	5	83	2	33	3	50	1	17
NPS	27	24	88	14	52	3	11	11	41	11	41	8	30	4	15
Total	254	206	81	120	47	14	6	100	39	107	42	60	24	128	50

[1]Percentages are rounded to the nearest whole number.

current group size regulations within the next five years. About 17% of areas plan to change or create limits over this time period. An additional six percent are unsure of their plans and are waiting for a round of public involvement and research before they decide what to do. Of those planning to make a change, most thought they would lower the group size limit. Only four areas indicated they might increase the allowable group size, and no areas said they planned to eliminate their group size limits. Twenty-six areas without a current group size limit said they planned to establish a limit in the future.

Discussion

Washburne and Cole (1983) found that 48% of all wilderness areas, regardless of agency, had placed a limit on group size. Our findings suggest about 51% of all areas currently have such a limit. This suggests little overall change over a 16-year period.

A very different picture emerges when change across time within agency is examined. For example, in 1981, Fish and Bury found that 46% of all USFS wilderness managers had limited group size. This increased to 58% in the 1983 Washburne and Cole study. Our data suggest that 73% of USFS wilderness areas currently have a group size regulation. Similarly, Marion and others (1993) reported that about 62% of all NPS wilderness and backcountry areas had group size limits in 1993. We found that 68% of NPS wildernesses currently have group size limits. Some of our higher agency percentages might be explained by our lack of a census of all areas: Presumably, those areas without group size limits would be less likely to return their group-size-limit survey than those with limits. Nevertheless, we believe that there is an increasing trend toward enacting group size limits within the USFS and the NPS. The reason that the trend for all areas is essentially flat is likely because of the inclusion of many BLM areas and some F&WS areas into the NWPS in the late 1980's and into the 1990's; most of these areas have no group size limits.

In wilderness areas with limits, the trend appears to be toward reducing maximum allowable group size, at least for people. Cole and others (1987) summarized past studies and found that party size limits ranged from 5 to 60. The most common limit was 25. Limits on packstock ranged from 5 to 50, but the most common limit was 20. Our data, summarized across all agencies, suggest that the most common group size limit for people is 10; the median is 12. For horses and packstock, the most common limit is 25, but the median is 15.

Our respondents agreed with Cole (1989) and Cole and others (1987) in listing environmental impacts very frequently and conflicts between groups quite frequently as reasons for adopting group size regulations. However, other frequent reasons given for group size limit seem somewhat more problematic. For example, about half of all areas with limits reported that they did so at least in part to be consistent with neighboring wildernesses. This is in some respects admirable; it seems wise to present consistent minimum impact messages and management regulations to the public. But not all areas, or zones of areas, have similar

susceptibility to impact. This also suggests that the wilderness manager may not have carefully evaluated the benefits and costs of group size limits in his or her area.

Managers in our study frequently mentioned conflict between groups as a reason for group size limits, while far fewer mentioned public complaints/pressure as a reason for adopting limitations. We assume that managerial concerns about conflicts from encountering large groups are based on prescriptions contained in the minimum-impact literature (such as Cole 1989, Cole and others 1987), rather than on reports from their visitors. While such prescriptions and rationale do merit management consideration, these approaches are often not grounded in empirical research.

A Decisionmaking Framework

Investigations into the development of a "carrying capacity" for wilderness concluded that while measurements of biophysical and social conditions are invaluable aids in decisionmaking, they cannot be the sole determinants for management decisions (Stankey and others 1990). Careful, value-based decisions must often be made in defining visitor limits and for management actions. The subsequent development of planning frameworks such as Limits of Acceptable Change (LAC) (Stankey and others 1985) and Visitor Impact Management (VIM) (Graefe and others 1990) are based on this premise and, to date, represent the most effective efforts to maintain a high standard of resource and social conditions. We believe that the management of group size can benefit from a similar process— a clear decisionmaking framework (figure 1). This suggestion is not made to diminish the importance of additional research into the many social and biophysical aspects of group size, but rather represents a parallel effort to move forward with thoughtful management on this important issue.

The Wilderness Act mandates that wilderness areas "… should be administered for the use and enjoyment of the American people in such a manner that will leave them unimpaired as wilderness, and so as to provide for the protection of these areas." The act goes on to specify that wilderness areas should provide "outstanding opportunities for solitude or a primitive and unconfined type of recreation." This dual mandate is the challenge of the wilderness manager—to provide for visitor access and simultaneously preserve and protect resources and social conditions. The degree of conflict in these dual mandates depends on many factors, many of which are area-specific. Total amount of visitation, season of use, visitor use patterns, types of activities, availability of resistant substrates for campsites and geographic features to name a few, can play a role in the degree of compromise required for meeting competing stakeholder demands. Moreover, managing visitors is even more difficult given the range of legitimate uses, such as commercial outfitting, educational groups, etc., that at times appear to conflict with the private individual visitor. Despite the fact that guided and educational groups represent a small proportion of the total use in wilderness (Morton, personal communication), they can serve broad societal needs.

Given these challenges, the proposed decisionmaking framework approaches this issue from a broad, hypothetical perspective to examine what alternatives might be available to the wilderness manager. Step one in the framework presents three possible management positions: 1) little or no compromise on protection (of social conditions and resources); 2) free and open access for recreation as the priority; and 3) a compromise between the two. There are costs and benefits associated with each of these positions. For example, with no compromise on protection, total use levels would be low, and use would be restricted to small groups (for example, four to six persons). The benefit, of course, would be a high degree of wilderness protection. The cost would be elimination of or reduced access for many. Visitors who prefer a large group would be affected; in particular, services such as guided outings and educational experiences would likely be eliminated or reduced. The opposite position, free and open access, would allow for use of wilderness free from regulation, but at the cost of a high potential for resource and experience impact.

Some sort of compromise between these two extremes is likely to be the preferred option. Step two in the process addresses this situation by offering three possible options, all of which assume some degree of compromise. These are: 1) Emphasize resource and experience protection; 2) emphasize offering wilderness access to the broadest range of wilderness visitors; and 3) find a middle ground between the two. If the desire is to emphasize resource/experience protection, lower group size limits would be sought. Moderate limits would be desirable for the middle ground and higher limits for an emphasis on providing access to the wilderness.

Regardless of the decision made in step two, step three involves deciding whether 1) to impose a uniform limit across the entire wilderness area, or 2) to employ a spatial/temporal zoning approach to develop two or more group size limits across the area. This step also involves setting the group size limits for the remainder of the process for both the uniform limit and zoning options. If there is zoning, several use limits must be set. Different places and portions of the wilderness must be allocated to each zone and the associated group size limit. In making these decisions, consider 1) the proportion of the wilderness in each group size class, and 2) developing specific criteria for allocation to each group size zone. For example, areas where larger groups are allowed should have a high resource tolerance for large groups and a low probability that large groups would impact the experience of other visitors; this would be accomplished through geographic or temporal separation. In the uniform limit option, important considerations are the extent to which protection and access should be balanced and the equity of the single limit for all types of legitimate uses.

Step four considers whether certain groups should be given exemptions, and be allowed to travel in a larger group. Some factors to consider would be whether the sponsoring organization and/or leaders of the group can clearly demonstrate a high level of minimum-impact proficiency, the ability of the agency to regulate and monitor the group's activities and the value and importance of the service being

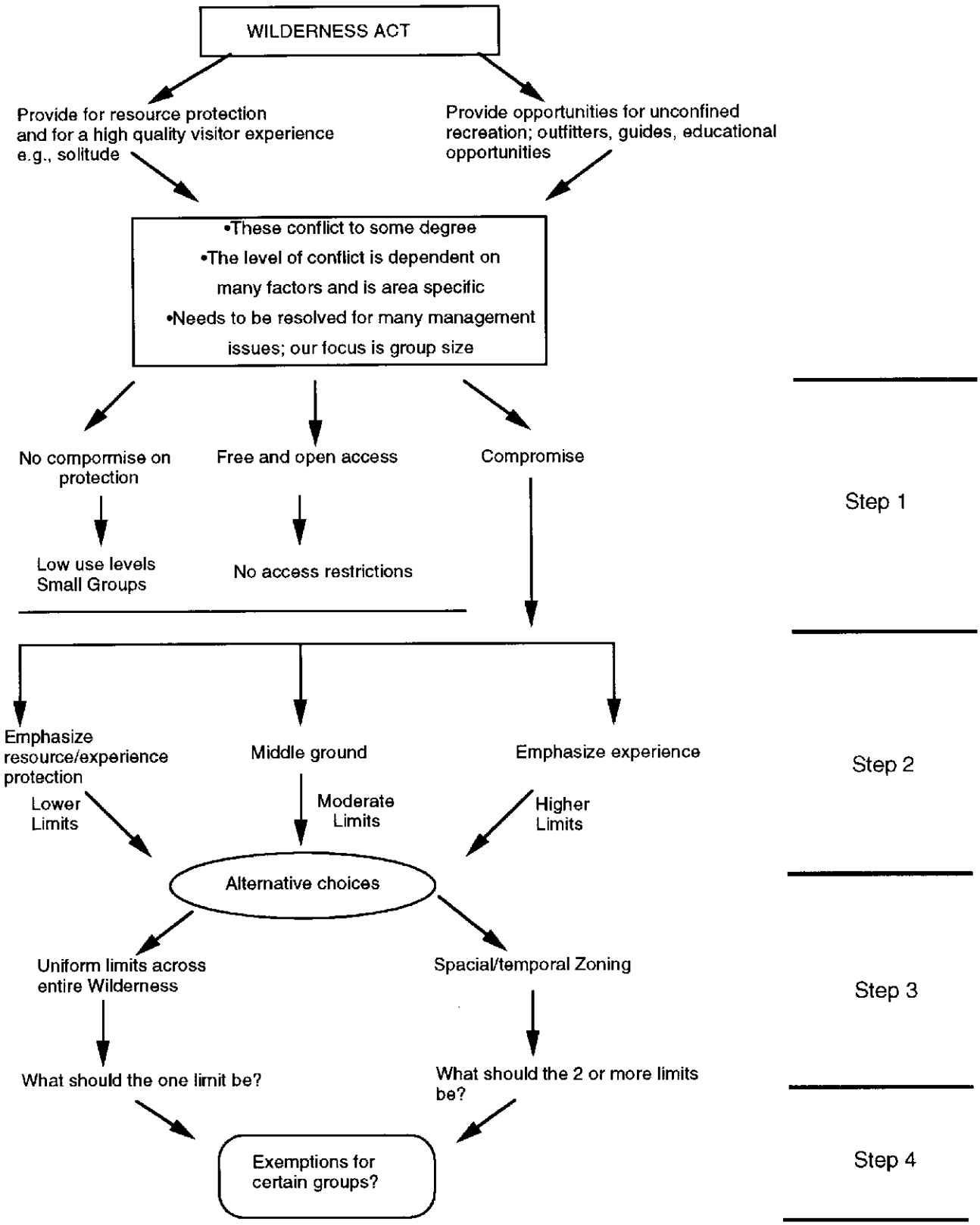

Figure 1—A conceptual model for making group-size decisions.

provided. Moreover, in many cases, larger, organized groups can conduct service projects that further wilderness management goals.

Conclusions

Limiting group size is a common management approach with the overall goal of limiting ecological and visitor experience impacts. Currently, however, it is not clear how successful this approach has been in limiting impacts, with the exception of eliminating very large groups and their associated impacts. Within current limits, management of factors such as visitor behavior, overall visitor numbers, geographic and temporal separation of groups and site size and durability may be more effective in minimizing impacts than limiting group size.

It is essential that management decisions that limit the size of groups in wilderness be evaluated from a broad cost-and-benefit standpoint. While further research on the ecological and visitor experience implications of groups size remains important, careful and explicit decisions about how best to compromise between the costs and benefits of group size limits are critical to the process of setting a defensible group size.

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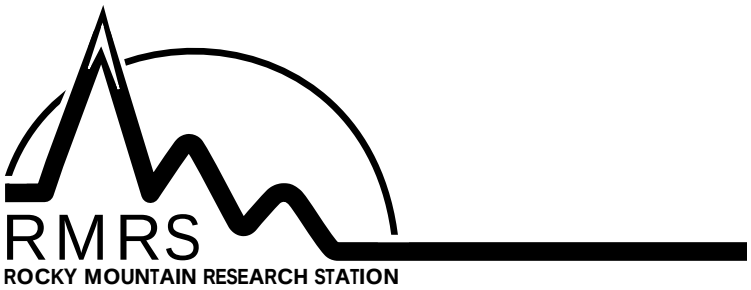

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