Congestion and Crowding in the National Park System

Edited by David W. Lime

- Information Gaps
- Trends
- Carrying Capacity
- Direct Management
- Indirect Management
- Expert Systems

Minnesota Agricultural Experiment Station
Miscellaneous Publication 86–1996
Congestion and Crowding in the National Park System: Guidelines for Management and Research

David W. Lime, Editor

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Acknowledgments

A 1993 National Park Service workshop in St. Paul, Minnesota, on Overcrowding in Parks formed the basis for this publication. A special thank you goes to the 35 individuals who joined us for this event and particularly to those individuals who prepared papers for distribution to participants before the workshop and revised their material afterward for inclusion in this volume. Thanks also is directed to Drs. Dorothy Anderson and Leo McAvoy, both faculty at the University of Minnesota, who helped host this event and to Jerrilyn Thompson, research fellow with the University of Minnesota Cooperative Park Studies Unit, for her efforts to coordinate the numerous arrangements associated with the workshop. Additional appreciation is directed to Clara Schreiber, University of Minnesota, Department of Forest Resources, for her word processing skill in putting these manuscripts into an attractive and standard format. Larry A. Etkin, experiment station editor, designed the cover, provided ideas for manuscript layout, and coordinated the printing of the camera-ready manuscripts and other text.

Thanks also goes to the six-member National Park Service advisory committee that helped guide the development of the 1993 workshop and the overall study of emerging issues concerning the management and use of National Park System areas in the Midwest Field Area. The committee (with their current location) included: Steve Cinnamon and Dennis deKay, Midwest Field Area Office; Joseph Hudick, St. Croix National Scenic Riverway; Steven Kesselman, Salem Maritime National Historic Site; Peggy O'Dell, Ozark National Scenic Riverway; and Grant Petersen, Pictured Rocks National Lakeshore. The workshop was a direct response by regional National Park Service employees to better understand and address questions of overcrowding and congestion in parks over the next several decades.
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# Table of Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestion and Crowding at Parks and Related Areas: Narrowing the Gap</td>
<td>1</td>
</tr>
<tr>
<td>David W. Lime</td>
<td></td>
</tr>
<tr>
<td>Trends in Congestion and Crowding at Recreation Sites</td>
<td>9</td>
</tr>
<tr>
<td>David W. Lime, Stephen F. McCool, and Denis P. Galvin</td>
<td></td>
</tr>
<tr>
<td>Crowding and Carrying Capacity in the National Park System: Toward a</td>
<td>27</td>
</tr>
<tr>
<td>Social Science Research Agenda</td>
<td></td>
</tr>
<tr>
<td>Robert E. Manning and David W. Lime</td>
<td></td>
</tr>
<tr>
<td>Alleviating Congestion in Parks and Recreation Areas Through Direct</td>
<td>67</td>
</tr>
<tr>
<td>Management of Visitor Behavior</td>
<td></td>
</tr>
<tr>
<td>Stephen F. McCool and Neal A. Christensen</td>
<td></td>
</tr>
<tr>
<td>Is Your Park Being &quot;Loved to Death&quot;?: Using Communications and Other</td>
<td>85</td>
</tr>
<tr>
<td>Indirect Techniques to Battle the Park &quot;Love Bug&quot;</td>
<td></td>
</tr>
<tr>
<td>Gail A. Vander Stoep and Joseph W. Roggenbuck</td>
<td></td>
</tr>
<tr>
<td>The Potential of an Expert System to Address Congestion and Crowding</td>
<td>133</td>
</tr>
<tr>
<td>in National Park System</td>
<td></td>
</tr>
<tr>
<td>Gregg Flekke, Leo McAvoy, and Dorothy H. Anderson</td>
<td></td>
</tr>
<tr>
<td>February 1993 Workshop Participants</td>
<td>143</td>
</tr>
</tbody>
</table>
Introduction

Crowding and congestion in parks and related areas is not a new problem. Neither is it without a long history of dialogue concerning how to address critical issues and impacts. The National Park Service (NPS) is not alone in trying to balance the responsibility for providing opportunities to appreciate and enjoy parks and related areas against an ever increasing populace and the need to protect a diversity of natural, cultural, and historic resources for future generations.

The growing popularity of frontcountry and backcountry areas is challenging the most talented resource professionals at all levels, both domestic and international, to find more innovative solutions to problems.

The papers in this volume are intended to help narrow the gap between what is and is not known about how to define crowding and congestion at parks and related areas, and how to address problems these conditions create. A major contribution of these papers also is to identify essential information and research which is needed to help answer unresolved questions and gaps in knowledge concerning this elusive topic.
While recognizing the important role of the biophysical sciences in addressing problems associated with congestion and crowding, this publication focuses on the role of the social sciences in information gathering and decisionmaking. In reality, the contributions of the social and biophysical sciences toward finding solutions for these problems are not mutually exclusive. The answers provided by each area of inquiry contribute to our base of knowledge and understanding.

The foundation for this publication was a 1993 workshop in St. Paul, Minnesota, attended by approximately thirty-five NPS employees and research cooperators. The workshop was an extension of research by the University of Minnesota's Cooperative Park Studies Unit (CPSU), aiming to identify emerging issues facing the NPS over the next two decades. Overcrowding in parks was identified by NPS Midwest Field Area (Midwest Region at the time of the workshop) employees as an issue of growing concern for the years ahead, and it became a focus for this event.

Another important objective of the 1993 workshop was to continue developing a research agenda for social science in the Midwest Field Area.

As background for the workshop and this publication, the Minnesota CPSU surveyed employees within the Midwest Field Area in 1992 to identify emerging issues concerning the management and use of NPS facilities in the region (Parker et al. 1992, 1993a,b,c). Three hundred permanent employees were randomly selected for the study, from a pool of 891 possible participants. All 33 park units, including the regional office and the range of job types were represented in the sample.

A modified Delphi method was employed in the CPSU study. In a letter, the initial question asked participants:

> From your point of view, what are the most important issues that your park or other Midwest Field Area Parks will face in the area of park management and use over the next 10 to 15 years?

The response rate from the initial contact of participants was just over 75 percent. At least one response was received from each park unit. The responses received were entered verbatim into a computer database and evaluated using a content analysis procedure. From those responses, two separate themes and an associated list of issue statements were developed. One theme addressed organization management and included 13 separate issues. The second theme dealt with natural resource/visitor management and human use. It included 17 issues.

The two lists were mailed to all study participants, who were asked to identify additional issues they felt should have been listed but were not. Participants also were asked to rate the relative importance of each issue within the two themes. Again the response rate was 75 percent.

A prioritized listing of issues was generated for each of the two broad issue topics or themes (tables 1 and 2). "Increasing visitor use numbers causing overcrowding in parks" was ranked highest among the Natural Resource/Visitor Management and Human Use Issues, but other highly ranked issues...
were conceptually related to the topic of congestion and crowding at NPS units and ways to mitigate unwanted impacts. These included:

1. Need to play a greater role in environmental education; and to become a lead agency educating the public on regional and global environmental issues.

2. Increasing need to educate the visitor.

3. Increasing conflict between the need to preserve and the demand for use, especially uses that may be incompatible with the park, such as ATVs, 4x4s, and snowmobiles.

4. Increasing inappropriate activities within the park including crime, vandalism, looting, and drug and alcohol use.

5. Increasing conflicts among users.

Table 1. Issue statements—organization management issues

<table>
<thead>
<tr>
<th>Issue</th>
<th>Organization Management Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Inability of budgets and funding within the NPS to keep up with growing needs.</td>
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<td>2.</td>
<td>Lack of adequate grade structure, career paths, salaries, benefits, and rewards to recruit and retain highly qualified personnel.</td>
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<td>3.</td>
<td>Increasing political interference that conflicts with professional judgments, including the increasing role of the Congress-person.</td>
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<td>4.</td>
<td>Inability to keep pace with the deterioration of equipment and facilities.</td>
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<td>5.</td>
<td>Increasing bureaucratic and administrative “paperwork,” often only marginally related to the NPS’s mission.</td>
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<tr>
<td>6.</td>
<td>Budget and personnel limits resulting in excessive workload on existing staff.</td>
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<td>7.</td>
<td>Ineffective management and leadership within the NPS.</td>
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<tr>
<td>8.</td>
<td>Increasing pressures on planning and management due to mandates expressed in laws or regulations.</td>
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<tr>
<td>9.</td>
<td>Lack of staff with sufficient professional and educational training to meet current and emerging needs.</td>
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<td>10.</td>
<td>The addition of inappropriate new units to the system.</td>
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<td>11.</td>
<td>Excessive middle- and upper-level management and administration.</td>
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<td>12.</td>
<td>Inability of women and minorities to attain high level positions in the NPS and the failure of equal opportunity and affirmative action programs.</td>
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<td>13.</td>
<td>Lack of an influential and meaningful philosophy within the NPS.</td>
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Based on the interrelations of congestion and crowding in park and recreation areas, the concept of carrying capacity, and the important mitigating roles of education, communication, and direct management of visitor behavior, a workshop was proposed to explore the scope of existing knowledge about these topics. It was hoped that through dialogue among park planners, managers, and the research community, progress could be made in helping the Midwest Field Area, and the NPS at large, identify elements of a social science research agenda to address these and related questions.
Table 2. Issue statements—resource and visitor management and human use issues

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<thead>
<tr>
<th>Issue</th>
<th>Natural resource/visitor management and human use issues</th>
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<tbody>
<tr>
<td>1. Increasing visitor use numbers causing overcrowding in parks.</td>
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<td>2. Encroaching pollution from outside the park.</td>
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<tr>
<td>3. Increasing need to effectively manage endangered and threatened species.</td>
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<td>4. Encroaching development adjacent to the park.</td>
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<td>5. Need to play a greater role in environmental education; and to become a lead agency educating the public on regional and global environmental issues.</td>
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<td>6. Increasing air and water pollution in the park.</td>
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<td>7. Increasing need to educate the visitor.</td>
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<td>8. Increasing encroachment of exotic species into the parks.</td>
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<td>9. Increasing risks to the park due to global environmental changes such as acid rain, ozone depletion, and global warming.</td>
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<td>10. Increasing conflict between the need to preserve and the demand for use, especially uses that may be incompatible with the park, such as ATVs, 4x4s, and snowmobiles.</td>
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<td>11. Lack of adequate biophysical baseline data.</td>
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</tr>
<tr>
<td>12. Increasing inappropriate activities within the park including crime, vandalism, looting, and drug and alcohol use.</td>
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<tr>
<td>13. Changing user groups and user needs and expectations, including increasing use by seniors, minority groups, and persons with disabilities.</td>
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</tr>
<tr>
<td>14. Increasing need to understand who are the users and what are the users’ needs.</td>
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</tr>
<tr>
<td>15. Increasing development within parks by the NPS, concessionaires, and private land owners.</td>
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<tr>
<td>16. Lack of effective cooperation and partnerships with business, private organizations, or other government agencies.</td>
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<td>17. Increasing conflicts among users.</td>
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</tbody>
</table>

Workshop Activities

Attendees at the three-day workshop (February 23-25, 1993) included park superintendents, interpreters, rangers, administrators, and scientists. They were primarily NPS employees from the Midwest Field Area, with additional participants being staff from NPS’s Denver Service Center (the principle planning unit for the NPS), and both NPS and non-NPS social scientists conducting studies in park units nationwide and internationally. Workshop participants are listed at the end of this volume.

The workshop schedule permitted a half day of discussion for each of four interrelated topics:

1. Understanding the evolution of research concerning crowding and carrying capacity in the National Park System and how capacity frameworks can aid planning and management of crowding and related issues.

2. Enhancing the capabilities of direct management of visitor behavior to alleviate congestion.
3. Enhancing the capabilities of communication (information, education, interpretation, and persuasion) and other indirect management techniques to address congestion and crowding.

4. Identify the capabilities of a computerized expert system to address congestion and crowding.

The topic for each workshop session was introduced with a short (30 minutes or less) presentation. These introductions were based on draft papers distributed to participants before their arrival at the workshop.

For most of the issues, participants were divided into several small work groups to evaluate the content of papers and the topic from three perspectives:

- What is known about the topic,
- What is not known about the topic—specifically what has not been addressed through social science research, and
- What social science research is needed to close the gap between what is and is not known.

The workshop on the expert system (number 4 above) was primarily a demonstration, so the format was slightly modified. However, participants engaged in spirited discussion about the benefits and costs of expert system technology and its application to management of congestion and crowding in National Park System units and related areas. The authors of the papers helped lead the small group discussions, and the deliberations of that dialogue were used by the authors in the preparation of their final manuscripts which appear in this volume.

Products and Spin-offs from the Workshop

This volume is one direct product of the 1993 Minnesota workshop. The four papers discussed at the event have been recently revised to reflect additional current research and management activities as well as to include the evolution of conceptual thinking about these topics over the past three years.

A paper by Lime et al. (1995) from the recently published Proceedings of the Fourth International Outdoor Recreation and Tourism Symposium and the 1995 National Recreation Resource Planning Conference is reprinted in this volume to provide additional insight and perspective concerning issues of congestion and crowding at recreation sites (with minor modifications to reflect the format for this publication, and to update mailing addresses and several references). Other papers from that proceedings (Thompson et al. 1995) should be of interest to readers of this volume, and may benefit further discussions concerning crowding and congestion.

Several studies in the Midwest Field Area and beyond have been initiated or encouraged as a result of this research on emerging park issues.

In 1995, two studies were initiated to address concerns associated with congestion and crowding on the St. Croix National Scenic Riverway in...
Minnesota and Wisconsin. The studies focused on growing use of islands and shorelines by boaters and what to do about apparent impacts. Boaters (Dalton et al. 1996) as well as residential property owners living in the riverway corridor (Thompson et al. 1996) have been contacted for their opinions.

At Perry's Victory and International Peace Memorial in Ohio, park managers and visitors are concerned about visitation levels and patterns and the congestion associated with visitors waiting in line for the elevator to ascend the 317-foot column to the open-air observation deck. This 1996 study is addressing visitors' perceptions of problems encountered at the memorial concerning congestion and crowding as well as their ideas about management actions to deal with such problems.

A 1996 study at Mount Rushmore National Memorial in South Dakota is focusing on the emerging use of the park by rock climbers—a use that was almost nonexistent in the late 1980s, but in 1996 attracted more than 4,000 climbers to the park. Onsite interviews and questionnaires assessed climbers' attraction to this site, problems they have encountered with the rapidly growing visitation, and their support or opposition to various visitor use management actions.

The deliberations of the 1993 workshop and production of this volume have, in part, spurred a growing body of research associated with the NPS Visitor Experience and Resource Protection (VERP) process to address questions about carrying capacity (see Manning and Lime [1996] in this volume). Ongoing or recently initiated research in Arches National Park (e.g., Manning et al. 1996a,b), Glacier National Park, Acadia National Park, Isle Royale National Park, Mount Rainier National Park, and the work at the St. Croix National Scenic Riverway and Perry's Victory and International Peace Memorial are all contributing to a broader array of park settings or types of park units for study and is providing new opportunities to test ways to measure indicators and standards of quality of the visitor experience. The testing of alternative procedures to monitor indicators of quality also has been enhanced through these studies.

Related to VERP, new research at the CPSU is compiling and evaluating the capability of various management strategies and tools to protect the quality of the visitor experience and the integrity of park resources (Wang et al. 1996). In collaboration with the Denver Service Center, a handbook is being developed, and will be evaluated, to address biophysical and experiential impacts associated with recreation use. The handbook identifies more than 30 management tools and strategies, summarizing and describing their purposes, costs (pro and con) to managers and visitors, and effectiveness to meet desired objectives. Wherever possible, methods of implementation and specific field examples from the private and public sector are discussed.

Social science research is contributing to understanding crowding and congestion in the National Park System and elsewhere. This volume, while not covering the breadth of research and management on these topics, helps make some of the issues and needs for research clearer, and reinforces the conclusion
that social science can make important contributions to decisions about these and related problems (Lime 1996, NPS 1996).

It is hoped that many of the ideas and research recommendations outlined in this volume will be used by policy makers and others to help guide needed action concerning congestion and crowding at our highly-prized National Park System. Progress has been and continues to be made, but efforts need to be accelerated both to implement ideas and actions that are known to work as well as to initiate more research to narrow the information gap!

**Literature Cited**


Introduction

Nearly all of us have experienced problems associated with congestion and crowding in parks, and these problems have been recently popularized (e.g., Adler and Glick 1994, Manning 1995, Mitchell 1995, Wilkinson 1995). Parking lots can be full or overflowing. Lines can be long and waiting for service can be irritating and stressful. Traffic patterns and flows can resemble urban area rush hours and occasionally result in gridlock. Busy telephones can make contacting site managers for information impossible. Once at the site, direct contacts with area personnel can be nonexistent or very limited. Limited and overworked staff unable to deliver quality service can result in unhappy customers and employees alike. Campgrounds and other sites are often full by midmorning and many people are turned away. Competition among vacationers and squabbling over available sites can give visitors the impression that chaos is the normal style of operation. Restrictions on recreation

Introduction .......................... 9
Some Truisms and Patterns Concerning Congestion and Crowding .................... 10
Workshop Deliberations and Implications for Public Policy, Planning and Management, Tourism, and Research .................. 19
Public Policy .......................... 20
Planning and Management .... 21
Tourism .................................. 22
Research ............................. 23
Conclusion ................................ 24
Acknowledgements .................. 24
Literature Cited ......................... 24


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activities, party size, equipment, length of stays, pets, and other aspects of an outing can make trip planning a major challenge. The need for reservations, advance bookings for some activities, fees, and limitations on numbers of vacationers allowed through the gate inconveniences or discourages some visitors to the point that they stay home—or at the very least it forces them to cope if they do venture into the great outdoors. Increasingly, it has become obvious that use of many sites exceeds their design capacity—congestion and potential crowding threaten to impact not only the quality of the visitor experience but also the integrity of biophysical and cultural resources. Managers have been challenged to develop strategies that address these situations. The development of ideas and principles concerning recreation carrying capacity over the past three decades is one response to these challenges. Management of congestion was a focus of one workshop at the symposium, and the findings and recommendations of this workshop are reported in this proceedings (Manning et al. 1995). Several planning frameworks have been developed—e.g., Limits of Acceptable Change (LAC), Visitor Impact Management (VIM), Visitor Experience and Resource Protection (VERP), Carrying Capacity Assessment Process (CCAP), Quality Upgrading and Learning (QUAL)—and all stress the critical need for management objectives expressed as indicators and standards of quality. The indicators and standards specify acceptable or tolerable limits of change to biophysical and experiential conditions. Monitoring activities documents trends and helps determine whether acceptable conditions have been violated.

This paper addresses trends in congestion and crowding at recreation sites by (1) identifying selected truisms or patterns concerning congestion and crowding at recreation sites to demonstrate the breadth and complexity of this topic, and (2) summarizing the discussion at the symposium workshop on congestion and crowding with respect to the implications of such trends to public policy, planning and management, tourism, and research.

Some Truisms and Patterns Concerning Congestion and Crowding

As a way of introduction, it is important to define both congestion and crowding as they relate to park and outdoor recreation settings. Congestion refers primarily to the physical conditions that occur during periods of high density use when infrastructures and services are seriously stressed. Under such conditions there is often a lack of available parking spaces and visitors spend much time driving around looking for places to park, there is competition among visitors to access facilities and services, water and sewage systems are near capacity, campgrounds and picnic areas are near or more than 100 percent occupancy, and reservation and quota systems are full and some visitors are turned away. To accentuate problems further, site development frequently has not kept pace with demand—often park and recreation infrastructures, such as facilities and transportation systems, have been static for many years.
Crowding, on the other hand, is a concept in which the number or type of people encountered exceeds an individual's normative standard for a preferred experience. Definitions of crowding extend beyond numbers or types of people encountered and address behaviors encountered such as noisy individuals, visitors walking off the designated trail, or the presence of visitors with unruly pets.

The congestion and crowding question comes together primarily because of the intersection of three factors and trends: (1) the increase in numbers of visitors to outdoor recreation areas, (2) a relatively static facility and transportation infrastructure, and (3) changes in visitor use patterns (figure 1). Such patterns and trends have combined to produce a series of conditions that public and private recreation providers as well as visitors find unacceptable, are uncomfortable with, or prefer to avoid.

![Growth in number of visitors to recreation sites](image)

**Figure 1.** Congestion and crowding are caused primarily by the intersection of an increase in numbers of visitors, a relatively static site infrastructure, and changing visitor use patterns.

A variety of variables influence how these trends collide at any particular site: its geographic location; the management system; the biophysical, cultural, social, and managerial conditions present; and the type and nature of visitation it attracts. Also important is the regional context in which the site is located.

While it is possible to specify some general patterns associated with congestion and crowding, finding exceptions generally is easy. Nevertheless, the following trends illustrate the dynamic nature of this topic and why it represents such an important issue in future discussions concerning outdoor recreation policy, planning and management, commercial tourism activities, and research.

**Generally speaking, numbers of visitors to private, local, and other public parks and recreation areas continue to grow.**

Visitation at most types of sites continues to increase—probably not at the rapid rates of the 1960s and 1970s, but nonetheless upward. Some sites experience a trend in which the annual rate of growth is relatively flat with increases of 1 or 2 percent per year being common. Other attractions, however, have witnessed more rapid growth with increases of double-digit proportions.
At Arches National Park in Utah, for example, visitation increased nearly 170 percent between 1980 (290,000 visits) and 1994 (777,000)—an increase of about 8 percent each year. Preliminary estimates for 1995 suggest an increase of at least 11 percent from last year, and area managers believe the trend will continue.

In general, numbers of visitors to frontcountry areas are growing faster than to backcountry settings.

Probably the most rapid growth in visitation will continue to occur in frontcountry rather than backcountry settings. Many studies and agency visitor-use reports document the leveling off of visitor use in wilderness and other dispersed, backcountry areas over the past one to one and one-half decades (e.g., Lucas and McCool 1988, Lucas and Stankey 1989). In the Bob Marshall Wilderness in Montana and for backcountry in Yellowstone and Glacier national parks, for example, visitation has remained relatively constant over the past two decades. Participation in river recreation, such as whitewater rafting and innertubing, also has witnessed a leveling off in growth. Declines in use were especially common after the early 1980s. While many expect similar patterns to continue, some evidence suggests that use of some backcountry settings is rebounding and showing annual growth greater than during the past decade or so.

On the other hand, frontcountry areas of nearly all types and descriptions (the more developed portions of parks and recreation areas reached easily by vehicle or short walks) have frequently experienced explosive growth in visitation. Much of this use is characterized by sightseeing, driving for pleasure, visiting interpretive centers or other developed facilities, and taking relatively short walks to attraction sites. Other frontcountry pursuits take place near parking lots and trail heads and include activities such as mountain biking and rockclimbing. For example, mountain biking on the Moab Slickrock Bike Trail in east-central Utah has grown over a very few years from almost nothing to about 100,000 riders in 1994. At Mount Rushmore National Monument in the Black Hills, the number of rockclimbers in this 1,300-acre area has grown from fewer than 50 people in 1987 to at least 4,000 in 1995. Most climbers walk only a few hundred feet from their vehicles (often parking in undesignated parking areas along park roadways) to begin their climbs. For a variety of reasons (some of which are expressed below) continued growth in visitation of these more easily reached areas will be a trend well into the future.

There are significant temporal and spatial variations in congestion at specific locations.

The phenomenon of uneven use patterns at recreation sites represents a longstanding and well-documented pattern in which visitation demonstrates concentrations or peaks at certain times and locations. Many studies and agency reports have documented such trends. A study by Manning and Cormier (1980), for example, demonstrated frequent visitation patterns which show (1) consistent peaking on weekends and holidays, (2) extreme weekend peaking, (3) extreme holiday peaking, and (4) relatively consistent use across days of the use season.

Trends in Congestion and Crowding
Intra-area variation in visitation in which some areas are much more heavily used than others also is a common pattern in all types of park and outdoor recreation settings. Many studies have shown that even in the most heavily used wildernesses and frontcountry areas some places are congested while others receive little or no visitation. In Minnesota's Boundary Waters Canoe Area Wilderness, for example, only one or two lakes away from the most heavily traveled canoe routes one can find lakes and rivers with little or no traffic. And in this, the most heavily-visited wilderness in the United States, more than 70 percent of the nearly 30,000 parties that enter the area each summer do so through only 16 (21 percent) of the 77 entry points.

These and other examples of peak and off-peak visitation patterns create congestion and potential crowding problems. Because of this, managers often respond by developing facilities and services to meet peak demand. This can be inefficient, affect potential profits, and cause problems in scheduling employee activities and can result as well in much of the infrastructure going unused or underused much of the time. During peak times and in peak-use locations, a myriad of unacceptable impacts can occur both to resources and to the quality of visitor experiences.

Increasingly, congestion is being experienced in the shoulder seasons. The spreading out of visitation into the nontraditional lighter use times, such as spring and fall, has extended the "season" for potential congestion and crowding at many frontcountry and backcountry areas. All types of recreation providers have experienced this phenomenon. The National Park Service in the United States, for example, reports that shoulder season use (principally the months of April, May, September, and October) as a proportion of total use rose 11 percent in the twelve-year period from 1982 to 1994. The implications of such patterns are numerous and include the possibilities that: (1) the costs of doing business for managers will extend over a longer period causing greater stress on employees, facilities, services, and resources; (2) visitors attracted to areas during times of lower use and fewer congestion problems may be displaced or may be forced to accept lower quality experiences and services; and (3) biophysical resources will have less time to "recover" and may receive disproportionate impacts with an extended period of human contact.

The willingness and capability of large numbers of park and recreation visitors to shift their activity patterns to off-peak times to avoid congestion and crowding is problematic. Limited research and management experience exists to shed much light on the degree to which management actions and target marketing might be used to help redistribute some visitation into periods previously known to exhibit relatively low use and few congestion problems. (As noted in the previous section, there are questions about the desirability of such actions.)

Extending the research findings of Manning and Powers (1984), we offer some ideas concerning possible ways to achieve redistribution goals. These management strategies include (1) lower prices during off-peak times, (2) extended facility hours and opening/closing dates, (3) providing information
about congested and crowded times and locations, (4) developing vacation "packages" (lower prices or other incentives) for off-peak times, and (5) targeting or concentrating strategies on areas closer to known market areas. Getting visitors to shift their participation patterns from weekends and holidays to weekdays probably is easier than getting them to shift into the shoulder seasons. The target markets that offer the greatest potential to alter visitation patterns have the following characteristics: (1) people on flexible work schedules, (2) people who currently do some recreation during off-peak times, (3) vacationers seeking relatively long lengths of stay, (4) people without school age children, and (5) persons sensitive to crowding.

**Increasingly, the dichotomy between a static park and recreation infrastructure and a dynamic visitation pattern is creating stress on built systems and compromising the quality of the visitor experience.**

Park and recreation programs in the United States and elsewhere have undergone periods of development and expansion. Mission 66, for example, represented the last major period of national facilities upgrading and expansion for national park system units. In general the configuration of many park and recreation areas has been static for several decades. And, as we know, visitation has not been static. During the decades of the 1970s and 1980s, visitation to the national parks in the United States increased about 35 percent per decade. More than 265,000,000 visits were recorded in 1994; by the year 2000, the trend suggests that parks will receive more than 300,000,000 visits.

Increasingly, the dichotomy between static infrastructures and a dynamic visitation pattern results in compromising the quality of visitor experience and challenging management systems at all levels to maintain the status quo. Contrasting the situation at seven national park units by identifying the approximate year when the design capacity became static and displaying the changes in visitation since that year illustrates the nature and magnitude of the problem for one United States agency (table 1). Many parks have experienced major growth in visitation while their infrastructures have been static since 1960. Similar patterns and trends exist for local, state, and other federal agencies nationwide in the United States.

**Some attractions are congested and probably will stay that way because few or no substitutes exist.**

Outdoor attractions in the United States such as Old Faithful, Yosemite Valley, Washington Monument, Niagara Falls, South Rim of Grand Canyon, Mount Rushmore, and Cape Cod represent “must see” resources for many Americans and international visitors alike. For these and many other public and private attractions, high demand and congestion will continue to be a reality, and managers will have only limited success redistributing use to other locations and times as well as implementing other visitor use control strategies because these features are unique. Managers of these areas will be challenged to find innovative solutions to deal with increasingly more people wanting to experience these sites. Additional attention will be directed to administrators to consider crowd control actions such as transportation systems, day-use reservations, and pricing to ameliorate growing threats.
Increasingly, the dichotomy between a static United States National Park System infrastructure and a dynamic visitation has created stress on built systems and complaints about congestion and crowding.

<table>
<thead>
<tr>
<th>National Park Service unit and U.S. state</th>
<th>Approximate year when the design capacity became static</th>
<th>Change in visitation since year when design capacity became static</th>
<th>Average annual percent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assateague Island National Seashore (Maryland and Virginia)</td>
<td>1967</td>
<td>165</td>
<td>4.5</td>
</tr>
<tr>
<td>Channel Islands National Park (California)</td>
<td>1980</td>
<td>69</td>
<td>5.6</td>
</tr>
<tr>
<td>Denali National Park and Preserve (Alaska)</td>
<td>1975</td>
<td>239</td>
<td>8.7</td>
</tr>
<tr>
<td>Grand Canyon National Park (Arizona)</td>
<td>1960</td>
<td>296</td>
<td>4.8</td>
</tr>
<tr>
<td>Yellowstone National Park (Wyoming, Montana, and Idaho)</td>
<td>1975</td>
<td>79</td>
<td>3.9</td>
</tr>
<tr>
<td>Yosemite National Park (California)</td>
<td>1975</td>
<td>48</td>
<td>2.0</td>
</tr>
<tr>
<td>Zion National Park (Utah)</td>
<td>1960</td>
<td>298</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Source: Estimates by National Park Service personnel and the Socioeconomic Studies Division.

### Increasing numbers of tour groups and buses to some parks and recreation areas contribute to increasing differences between peaks and valleys in congestion.

A phenomenon common to North America and elsewhere is growing numbers of tour groups and buses in parks and recreation areas. While this trend is attributed to many factors, of particular importance is the growing number of people traveling internationally on tours and the aging of populations. Bus tours offer an important option for some of the traveling public because if this form of travel was not available it might curtail or eliminate their opportunity to visit many outdoor areas. Therefore, bus tours represent an important niche in the spectrum of travel options for a widening diversity of vacationers.

Numbers of tour buses entering the national park system in the United States illustrate the growth by this segment of the tourism market (table 2). In the past decade the number of buses has increased systemwide by 80 percent—from about 160,000 buses in 1985 to 291,000 in 1994. At individual parks, increases of 200 to 300 percent in the last ten years is common. At some parks, such as Arches National Park, few buses were present in 1985 (198 buses); in 1994, nearly 1,400 passed through the park. This represents nearly a 600 percent increase in 10 years! Park and recreation managers as well as tour bus company operators and their associations believe this trend will continue—perhaps accelerate in some locations.

In spite of their obvious benefits and contribution to the traveling public, one or more buses of 40 to 60 people can contribute significant congestion when disembarking at a visitor center, trail head, scenic overlook, or other attraction. Buses also can be noisy and their exhaust annoying, both of which can reduce the enjoyment and general quality of the experience for non-bus tour visitors present. Nevertheless, buses do accommodate their passengers with onboard toilet facilities and trash receptacles, which can help ameliorate some of their impacts. Some tour companies spend time with their customers to inform them about the impacts large groups can have on biophysical resources and the
experiences of other visitors and on appropriate behaviors to reduce such impacts.

Table 2. Growth in the number of buses traveling to selected United States National Park Service units and systemwide for selected years between 1985 and 1994.

<table>
<thead>
<tr>
<th>National Park unit and U.S. state</th>
<th>Number of buses by year</th>
<th>Percent change from 1985 through 1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arches National Park (Utah)</td>
<td>198 398 733 1,371</td>
<td>592</td>
</tr>
<tr>
<td>Bryce Canyon National Park (Utah)</td>
<td>1,452 3,993 4,586 6,925</td>
<td>377</td>
</tr>
<tr>
<td>Gettysburg National Monument (Pennsylvania)</td>
<td>5,987 5,707 6,198 10,776</td>
<td>80</td>
</tr>
<tr>
<td>Haleakala National Park (Hawaii)</td>
<td>4,886 10,006 8,175 15,853</td>
<td>224</td>
</tr>
<tr>
<td>Mesa Verde National Park (Colorado)</td>
<td>599 1,014 1,097 1,854</td>
<td>210</td>
</tr>
<tr>
<td>Mountezuma Castle National Monument (Arizona)</td>
<td>1,985 3,819 5,175 5,005</td>
<td>152</td>
</tr>
<tr>
<td>Muir Woods National Monument (California)</td>
<td>3,156 3,767</td>
<td>4,654 47</td>
</tr>
<tr>
<td>Yellowstone National Park (Wyoming, Montana, and Idaho)</td>
<td>2,951 3,519 4,149 5,305</td>
<td>80</td>
</tr>
<tr>
<td>Yosemite National Park (California)</td>
<td>5,442 9,563 11,973 15,726</td>
<td>189</td>
</tr>
<tr>
<td>Zion National Park (Utah)</td>
<td>1,524 3,724 4,253 5,099</td>
<td>235</td>
</tr>
<tr>
<td>National Park System</td>
<td>162,086 187,501 217,799 290,998</td>
<td>80</td>
</tr>
</tbody>
</table>

Source: National Park Service, Socioeconomic Studies Division.

Because of the steady growth in international visitation, opportunities for recreation site managers to use communication as a congestion management tool have become increasingly difficult. During some weeks at state and federal areas in the desert southwest of the United States, for example, the number of international visitors exceeds citizens from the United States. Travel continues to grow internationally at an accelerated rate, and managers increasingly are finding it difficult to communicate with prospective customers about a host of topics that would aid trip planning activities and onsite experiences. Some of this information could address issues related to congestion and crowding, such as descriptions of area use patterns, when and where to avoid congested locations, or times and ways to achieve desired experiences at sites that will be congested but cannot be avoided on this visit.

New and expanded information delivery systems will be needed to deal with an ever-expanding tourist audience—for international and domestic travelers alike. Particular attention will need to be paid to delivering information to people before they leave home and also when they arrive in the general area. Research has shown that reaching people in their homes is a critical place to influence

16 Trends in Congestion and Crowding
their trip planning activities. But many travelers arrive in an area with very limited ideas and information about places to go, things to do, and services available to accommodate their needs.

A variety of communication and information venues will unfold to aid international and domestic travelers. Because many international vacationers use bus tours, these companies and their associations will be an important link to these visitors. So will chambers of commerce, offices of tourism, public land management agencies, and other private sector providers.

Exciting and innovative opportunities also exist for computer technology and telecommunications to enhance worldwide and local communication. Internet resources such as the World Wide Web and Telnet illustrate a growing capacity to inform potential visitors about what an area has to offer and to help customers make informed decisions that match their desires, expectations, and needs (Lime 1995). This technology offers exciting new opportunities for public and private land managers, host communities, and the tourism industry to link resources and information in an effort to enhance service quality to the traveling public.

An example of the use of this new technology is the Interactive Visitor Information System (IVIS) being developed in Colorado as a public-private partnership among state, federal, community, and commercial tourism interests to provide quality information to potential visitors about attractions and services. The project hopes to link Internet and touch-screen systems so information can be accessed in a variety of ways. Related research is ongoing to employ Internet and geographic information system (GIS) technologies plus touch-screen capabilities to aid information dissemination for visitors interested in Minnesota's Boundary Waters Canoe Area Wilderness (Lime et al. 1995). Of course, such strategies need to be embedded within an overall congestion management strategy for an area or region.

Accompanying the growth in visitation at many recreation areas, visitors and managers often complain about crowding, congestion, and a loss in the quality of visitor experience.

In spite of a long history and large body of research on congestion and crowding, many questions remain concerning the elusiveness of crowding—what does "crowded" mean? How crowding is defined, of course, depends to a large degree on who you ask and the conditions associated with their experience. We have learned, however, that low density use and solitude are important attributes of many outdoor experiences, particularly for dispersed recreation activities and in wildland settings. In wilderness, for example, many studies document the desire to meet few people, and encountering somewhere in the range of three to six parties per day seems "about right" as a standard for an acceptable experience. In frontcountry settings, there is limited information to define crowding, and more research is needed to help unravel the relationships among visitor use, congestion, and effects (e.g., Manning et al. 1996).

Although some studies report significant visitor complaints about crowding and some do not, most people do have thresholds of tolerance for encountering other people and these thresholds can be quantified (e.g., Roggenbuck et al. 1991,
Shelby and Vaske 1991, Vaske et al. 1986). Generally, as the number of encounters increases so does the number of complaints. Of course, other factors in addition to sheer numbers influence definitions of crowding. Resource administrators also recognize the negative impacts of crowding. Several recent studies have addressed managers' perceptions of emerging issues facing agencies in the area of park management and overuse (e.g., Parker et al. 1992). In the Parker et al. study, "increasing visitor use numbers causing overcrowding in parks" was ranked highest of approximately 20 issue categories by National Park Service employees. Related issues included (1) increasing need to educate visitors about use patterns and appropriate behavior, (2) increasing inappropriate activities by visitors in parks, and (3) increasing conflicts among recreation users.

Because crowding and how it is defined is a normative concept, with varying definitions of acceptable use conditions, it seems appropriate for resource administrators to consider managing areas and regions for an array of use density conditions and opportunities. Normative standards could be specified for various management zones within an individual area as well as be assessed for numerous management zones among several agencies or providers within a larger setting. As such, normative standards about how much or what kinds of use can be tolerated before the quality of the visitor experience drops to an unacceptable level could be addressed in a regional context. Visitor information systems to aid trip planning could use this and complementary material to help vacationers match their wants with available resource conditions.

Increasingly, park and recreation managers are considering transportation systems, reservations, limitation of entry, fees, visitor information and education, visitor demonstration of skills/knowledge, and other use control strategies to ameliorate pressures from congestion and crowding.

While the magnitude of growth will continue to be debated, few in the leisure and outdoor recreation field believe the trend toward growing numbers of visitors to parks and recreation areas will not be upward. A major challenge will be to find more efficient and cost-effective ways to manage larger and larger numbers of people. Limiting numbers is one approach, but not the only one. Many strategies are available to the administrator, but unfortunately few have received rigorous testing and evaluation as cost-effective solutions (in terms of economic, social, and natural resource costs). We must try to guard against situations that result in tomorrow's problems! As journalist Eric Sevareid cautions, "the cause of most problems is solutions."

Some students of congestion and crowding at recreation areas advocate that transportation solutions can ameliorate such problems at some locations (e.g., National Park Service 1992). They call for consideration of fixed-rail and other stationary "people-mover" systems; mandatory use by visitors of public- or commercial-run buses to traverse the site; exclusion of personal vehicles in some or all areas and the use of shuttle rides to access key facilities; controlled roadways for personal vehicles; separate travel lanes or pathways for vehicles, bicycles, and pedestrians; and various strategies which address centralized and dispersed vehicle parking.
Such transportation systems probably will not be a panacea to resolve problems on a widely used basis. Most systems will be extremely costly to develop, implement, and maintain. Once implemented, flexibility for altering a system is largely eliminated, and the potential visual intrusion must be considered. Furthermore, construction budgets are being reduced for most public agencies with outdoor recreation responsibilities, so massive undertakings for such programs seems questionable. And, there are other important questions concerning public acceptance to the costs of using such systems as well as possible inconveniences, loss of personal freedoms, and other impacts to visitors' outdoor experiences. For example, to what extent might incentives be necessary to encourage visitors to leave their vehicles and travel in mass transit during at least part of their visit?

Other venues to limit and redistribute unacceptable visitation to parks and recreation areas will need testing and evaluation. These include various site hardening and management activities (e.g., durable surfaces, revegetation, barriers, landscaping, facilities) as well as efforts to manage visitor use through both direct (e.g., enforcement, zoning, restricting activities, reservations, limiting group size or lengths of stay) and indirect (e.g., fees, altering physical facilities, informing visitors about opportunities, requiring proof of knowledge/skills) use strategies (e.g., Peterson and Lime 1979; Brown et al. 1987; Cole et al. 1987). Probably some techniques will work better in combination with others rather than expecting one technique to "do it all."

While overnight reservation systems have been used frequently as a use-management tool, public agencies have limited experience using day-use reservations to manage visitation and congestion. Nevertheless, day-use reservation systems seem to hold promise and deserve further review and analysis.

Workshop Deliberations and Implications for Public Policy, Planning and Management, Tourism, and Research

The workshop explored a variety of trends associated with congestion and crowding. While many resource settings were discussed, much of the focus was centered on components of the United States' national park system. Clearly, congestion and crowding at all types recreation sites managed by a diversity of public and private recreation providers will not disappear and solutions to such problems will not come easily. Finding solutions is exacerbated by the realization that the previously presented trends concerning these issues probably are long term. Furthermore, resolving such issues is compromised because of limited physical space for expansion and development at many areas, reduced funding, limited field experience, and the intensity of feelings the public expresses about these areas and attractions. Nonetheless, a spirited discussion sought to answer questions about congestion and crowding in terms of public policy, planning and management, commercial tourism, and research.
Public Policy

Congestion and crowding lead to several public policy issues for nearly all agencies administering park and recreation resources. We note these issues are intertwined with the other issues discussed in the workshop. First, the decision space in which to address congestion is increasingly confined by a political and institutional environment oriented toward reduced funding and expenditures to deal with infrastructure concerns. Because some frontcountry congestion problems might be reduced through appropriate transportation and visitor facility investments, the reluctance to engage in these courses of action by the political system means such alternatives may generally be unavailable for public agency park managers. Resource administrators need to engage their publics to determine how much willingness exists to explore these alternatives—both a public involvement and research topic. The narrowness of the current political decision space leads to a policy situation in which public land managers may be forced to adopt less effective and potentially more volatile congestion management strategies.

Second, some solutions to congestion and crowding problems require exploring use limits (especially day-use limits) and allocation of use questions in settings where demand exceeds acceptable or tolerable limits. There are potential conflicts in allocating limited use opportunities, however, with components of the tourism industry that have become increasingly dependent on parks and recreation areas. The policy question revolves around how limited use opportunities can be allocated equitably and cost efficiently. In particular, the high visibility and growth of tour groups using buses could lead to policies discriminating against them. Past history of recreation use allocation suggests this will remain a contentious process.

A third policy issue concerns the nature of the dialogue that will be used to engage the public in decisions about congestion and crowding. Public land management agencies have traditionally followed a rational-comprehensive planning process. However, such planning approaches generally are appropriate only in situations where management goals are uncontested and cause-effect relationships are known. The lack of research on frontcountry visitors, noted elsewhere in this paper, suggests that few resource administrators enjoy this combination of circumstances. Thus, managers are challenged to design collaborative research, planning, and public dialogue processes that produce greater understanding and resolution of congestion and crowding issues.

A fourth major policy issue concerns the distribution of costs associated with congestion management, particularly the question of who pays for expensive development and maintenance costs of transportation systems and facilities. The peaking nature of visitation and other trends described earlier suggests that relatively small numbers of people (visitors) may directly benefit from investments made by a large number of people (taxpayers).
Planning and Management

The rise of congestion and crowding is inherently a planning and management question, but there are several specific implications of higher priority. A major question concerns allocation of lands within a park or recreation unit to varying recreation opportunity classes or management zones. Not all places within an area provide the same recreation opportunity or benefits—nor should they. Some places are and will continue to be inherently more congested than others (e.g., visitor centers, campgrounds, major attractions). Zoning an area can result in protecting locations currently uncongested or at least in earlier stages of congestion. Such zoning provides an overall framework for making difficult decisions about the location and type of appropriate development, transportation systems, and direct visitor management. Zoning also may reveal that the best place to solve congestion is outside a park, for example, through an intermodal transportation facility.

Second, several workshop participants noted the influence of inadequate and poorly located parking facilities in contributing to congestion and its effects. For example, filled parking lots lead to unnecessary driving around looking for a parking space, leading to further increases in road traffic. Lack of parking at unique features most likely contributes to visitor dissatisfaction resulting from being unable to access them. In addition, filled parking lots can lead to visitor safety and security concerns—mixing pedestrians with automobiles in low-visibility situations could result in injury. Crowded parking lots and congested areas also may be associated with criminal behavior.

Third, current visitor use patterns greatly influence how congestion can be managed. The present situation is usually a function of planning and management decisions made in the past—often many years ago. Visitors may be unwilling to give up access to key attractions. On the other hand, the increase in the proportion of day users occurring in many national parks and other sites may require fundamental rethinking of transportation management. Day users, those arriving in both buses and automobiles, have more constrained timeframes while in the area. Congestion management may require a better understanding of these timeframes (a research implication) and may need to seek more innovative approaches. Obviously, reducing congestion means visitors spend less time fighting traffic and more time at park attractions.

A related issue concerns transportation management and visitor expectations and behavior. Managing transportation cannot be conducted outside the context of other visitor management programs. For example, mass transportation systems need to be coordinated with opening and closing hours of visitor centers and timing of events such as naturalist-led interpretive trail hikes. Thus, changes made in transportation may affect the accessibility of park features and programs.

Fifth, improving a congestion transportation system could result in increases in visitor use and/or changes in the temporal distribution of use which could overwhelm other components of the park or recreation infrastructure. If, for example, current congestion associated with a transportation system is a major
barrier to visiting a park, removing this barrier may lead to rapid increases in overall visitation. Areas impacted by such increases may not be prepared to deal with new use levels and patterns. Thus, planning must look at transportation as one component of an interacting system.

Sixth, where mass transportation appears to be effective in addressing congestion, a number of significant and potentially volatile issues arise. These include size and location of staging areas (automobile parking, access roads, bus stops, shelters, and traffic control), number and type of buses required, visitor convenience, visual impacts, costs, assessments of real reductions in automobile trips, staffing, and maintenance. A decision to develop a mass transportation system is intertwined with many complex technical planning decisions that may preclude, reduce, or significantly delay implementation.

Finally, management needs a better understanding of how visitor behavior can be managed to reduce its contribution to perceptions of crowding and congestion. Research in backcountry settings concludes that visitor behavior often contributes as much to perceptions of crowding as do the absolute numbers. Therefore, researchers and managers should join forces to understand public perceptions better and to develop effective frontcountry strategies aimed at behaviors contributing to congestion and feelings of crowding.

Tourism

Of course, the people causing and affected by congestion are tourists. Our discussion focused on the implications of congestion for the tourism industry. A major concern deals with satisfaction among clients using commercial services such as lodges, hotels, campgrounds, group tour companies, and guides. These firms advertise to attract visitors to a park so they can enjoy a profit from these visits. Such advertisements may build unrealistic expectations about the experience or level of congestion (such as showing photographs of Glacier National Park's Going-to-the-Sun Highway with no or few vehicles on it), thus producing the potential for dissatisfaction. Clients also may be dissatisfied about congestion independent of expectations built through an advertisement. Such dissatisfactions may negatively affect these businesses through reductions in client purchases.

Second, management strategies to address congestion and crowding issues may result in direct limits on visitation, such as a limited offering of day-use permits. Processes used to allocate these permits may have differential effects on various types of businesses. Such allocation may introduce an element of uncertainty into a highly competitive environment, and some workshop participants warned that day-use limitations could negatively impact even the most efficient and well-run enterprises. Initially, it would not seem surprising for many tourism-based businesses to view allocation with considerable suspicion, given the limited field experience with such systems and a small research base available to aid their development and implementation.

Third, congestion management carries with it opportunities for collaboration between public resource management agencies and the tourism industry.
Congestion cannot be solved independently of the businesses and firms that survive on visitors and/or generate much of the demand for park features and values. Seeking reduced congestion and higher quality experiences seems a goal to which all can agree, and thus, the quest for a solution is perfectly suited for collaborative dialogue, a possibility hinted at under the public policy question above.

Research

Research can play important roles to aid policy, planning, management, and tourism development processes associated with congestion and crowding management issues. First, relatively little research has been conducted to assess visitor preferences and responses to congestion and crowding in frontcountry. The vast majority of research on such questions has been conducted in backcountry, wilderness, and wild river settings. The applicability of the research used in these settings is problematic, and there appears to be a limited consensus among researchers on the appropriateness of the various theoretical perspectives used in its design. Thus, not only does research have the formidable task of uncovering visitor preferences and attitudes about congestion and crowding in frontcountry, it must identify a defendable conceptual underpinning.

A related and second issue concerns the relative significance of various components of frontcountry visitor experiences. While encountering others may be important, other factors including party sizes and types, regulatory intrusions, access to information and interpretive materials also may influence the quality of the visitor experience.

A third implication concerns research on visitors to understand congestion related to displacement and replacement processes. Visitor ecology research not only would help managers better understand the consequences of ignoring or avoiding congestion issues, but also would provide information to help them understand the impacts of alternative congestion management strategies. For example, a switch to mass transportation from automobiles may displace certain people who highly value the independence afforded by automobiles. Visitor ecology research also may provide critical information about the attitudes of travelers, tourism providers, and others of various management strategies in advance of introducing such topics into a politicized planning atmosphere. Such research may indicate the types of people and institutions most vulnerable to various actions.

Lastly, more research is needed to aid the implementation and evaluation of various planning frameworks such as VERP, VIM, and LAC. While widely discussed and applied to varying degrees in the field, questions still remain about the range and nature of appropriate indicators and standards that define both social and biophysical conditions. Research also is needed to test and evaluate strategies to monitor whether or not acceptable conditions have been violated. Many examples exist of managers specifying indicators and standards, but often these efforts stop short of implementing a long-term monitoring program to assess trends. For example, to what extent can and
should visitors be utilized to help monitor indicators concerning experiential conditions when, in fact, the standards were based originally on the perceptions and attitudes of visitors?

Conclusion

The dual mission for many park and recreation providers is to conserve biological and cultural resources as well as provide for the enjoyment of people. Growing numbers of visitors to such areas threaten both goals and challenge managers to develop more innovative, efficient, and sophisticated methods to deal with larger and larger numbers of guests. Limiting numbers is not the only answer—but inevitably these impacts lead to a discussion of limiting visitation in some manner. Care must be taken to remember there are many techniques to address congestion and crowding problems, and some of them were addressed during the workshop and in this paper.

During the workshop probably more questions were raised than answered—perhaps the sign of a successful dialogue! The fact is, however, that most park and recreation areas will continue to experience more visitors, and, in spite of all the technical expertise, funding, and infrastructure available (or the lack thereof), cost-effective solutions (resource costs as well as economic and social costs) will not come easy. Through a future trend toward more collaborative research and planning as well as improved and thoughtful public dialogue with all the stakeholders, the stresses created by a growing leisure public can, we hope, be kept within "acceptable limits" well into the next millennium!

Acknowledgements

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Crowding and Carrying Capacity in the National Park System: Toward a Social Science Research Agenda

Robert E. Manning and David W. Lime

Introduction

As the name suggests, the National Park System comprises resources of national and, increasingly, international significance. The national parks, for example, contain natural, historical, and cultural resources of great importance and benefit to the nation and, in many cases, to the international community. Given the significance of this resource base, public demand to see and experience these areas is not surprising.

Data on visitation to the National Park System dramatically support this premise. Annual visits are now counted in the hundreds of millions. In the decade of the 1970s, visitation increased by 30 percent. In the 1980s visitation rose another 35 percent. If this trend continues, the National Park System can expect more than 300 million visits annually by the year 2000.

The increasing popularity of the National Park System presents both an opportunity and a challenge to the National Park Service (NPS). The opportunity is to fulfill the mission of the NPS "to provide for the enjoyment" of the national parks. The accompanying challenge, of course,
is to fulfill the other part of its twofold mission: to conserve park resources for the enjoyment of future generations. This can prove difficult under conditions of high visitation.

Implicit in this dual mission of the NPS is the issue of the quality of the visitor experience. The quality of visitor experiences must be maintained at a high level for the national park areas to contribute their full potential to the enjoyment of society. Moreover, high quality visitor experiences are more likely to develop public appreciation of, and support for, conservation of national parks and related resources.

It is ironic that one of the greatest threats to the quality of the National Park System is commonly seen as its increasing popularity. To many observers the national parks and other units of the system are crowded, at least in some places and at some times, and this detracts from the quality of the visitor experience. In more formal terms, some national park areas, or portions thereof, have exceeded their carrying capacity. These issues—crowding and carrying capacity—and the research needs surrounding them are the focus of this paper.

Discussions about crowding and carrying capacity have often centered on questions about large natural areas such as national parks and designated wilderness areas on other federal lands and waters. As such, the emphasis of planning, management, and research focused almost exclusively upon backcountry and related settings. In reality, however, questions about crowding and carrying capacity and how to address such problems, can and should pertain to all units of the National Park System. NPS managers of frontcountry settings in parks as well as those responsible for historic sites, monuments, and other areas, often deal with crowding problems of greater severity than those in backcountry settings. Concerns abound regarding highway traffic, parking, appropriate types and levels of commercial visitor services, people waiting to see or use attractions and facilities, visitors adversely impacting wildlife, visitors trampling trail-side vegetation and impacting soils, incidents of various depreciative behaviors, and other issues related to visitor enjoyment, safety, and security.

The ongoing study by the University of Minnesota Cooperative Park Studies Unit (CPSU) of emerging planning and management issues in the NPS Midwest Field Area highlights the concern about growing visitor use and crowding. Included under this topic are questions about how to address increasing conflicts among visitor groups, communicating with park visitors and other interested publics, regulating visitor use activities, and controlling inappropriate activities in parks such as vandalism and crime. Through this paper we hope to highlight some of what is known and not known about these important, but elusive topics. Particular attention is directed toward the identification of selected areas of needed research to address questions of crowding and carrying capacity. This paper is divided into three major sections. The first section reviews and synthesizes much of the research on crowding in the national parks and related areas. The second section addresses the issue of carrying capacity as a framework for managing crowding and related issues. The NPS's Visitor Experience and Resource Protection (VERP) process is introduced and
described along with a pilot application of VERP to Arches National Park. The final section outlines a number of research priorities based on review of the crowding and carrying capacity literature and on the deliberations of workshop participants.

Crowding in Parks and Related Areas

Crowding is usually seen as the most direct physical and psychological manifestation of increasing visitor use and is traditionally viewed as the dominant social impact of park visitation. An assumed negative relationship between increasing visitor use levels and visitor satisfaction is at the heart of concern over crowding.

The relationship between the level of visitor use and visitor satisfaction has been the subject of considerable conceptual and empirical study. Most of this research has been conducted in backcountry or other relatively low use settings. Nevertheless, crowding has been more complex than originally envisioned. In fact, in most empirical studies, little or no statistical relationship has been found between the level of visitor use and overall trip satisfaction. This was the case, for example, for hikers at Mt. McKinley National Park (Bultena et al. 1981) and river runners in Grand Canyon National Park (Shelby 1980). Why is this so and what does it mean with respect to understanding and managing crowding? Several answers are forthcoming from research on crowding in national parks and related areas.

Crowding as a Normative Concept

Crowding is best understood as a normative concept as defined in the sciences of sociology and social-psychology. Norms are personal beliefs or standards about appropriate behavior or conditions. Thus, crowding norms are personal beliefs or standards about the appropriate amount of visitor use or, more specifically, contact levels. Normative theory makes an important distinction between the amount of visitor use and crowding. The amount of visitor use is a physical concept relating number of persons per unit of space; as such it is strictly neutral and has no psychological or experiential meaning. Crowding, on the other hand, has a definitive social-psychological or evaluative meaning; it is a subjective and negative judgement about a given amount of visitor use. Thus, for the individual, visitor use may increase to a point where it is perceived to interfere or detract in some way with a desired experience. At this point, some degree of perceived crowding begins.

Numerous studies demonstrate that normative judgements about crowding in national parks and related areas are dependent upon a variety of circumstances. These circumstances can be grouped into three broad categories: (1) personal characteristics of visitors, (2) characteristics of other visitors encountered, and (3) situational variables.

Personal Characteristics of Visitors

Many studies have found that crowding norms are influenced by the personal characteristics of visitors. Visitor motivations have been consistently found to

Crowding and Carrying Capacity in Parks
influence normative definitions of crowding. A study of visitors to the Buffalo National River in Arkansas, for example, found wide diversity in perceived crowding among a sample of river floaters (Ditton et al. 1983). Visitor motivations were found important in explaining why some visitors felt crowded while others did not. Some visitors felt crowded and these respondents reported significantly higher ratings on the motivation "to get away from other people." Some visitors did not report feeling crowded and some reported that contact with other visitors enhanced their enjoyment of the trip. This latter group reported significantly higher ratings on the motivations "to be part of a group," "to have thrills and excitement," and "to share what I have learned with others." Similar results were obtained in a study of floaters on the Green and Yampa rivers in Utah's Dinosaur National Monument (Roggenbuck and Schreyer 1977; Schreyer and Roggenbuck 1978). Visitor motivations also were found to influence crowding perceptions of backcountry hikers in Yosemite National Park (Absheer and Lee 1981). While the amount of visitor use alone explained little of the variation in perceived crowding, the addition of respondent ratings of seven trip motivations substantially increased the variance explained in perceived crowding.

Visitor expectations and preferences for contacts with other visitors also influence crowding perceptions. A study of rafters on the Colorado River in Grand Canyon National Park found virtually no relationship between various use level/contact measures and perceived crowding (Shelby 1980). However, substantive correlations were found between perceived crowding and both expectations and preferences for contacts with other visitors. Similarly, only a weak relationship was found between use levels and perceived crowding among campers at Alaska's Katmai National Monument (Womble and Studebaker 1981). However, expectations and preferences for use level explained substantially more of the variation in perceived crowding. Likewise, only moderately strong relationships were found between visitor contacts and perceived crowding among hikers at Mount McKinley National Park (Bultena et al. 1981). Stronger relationships were found between perceived crowding and both preferences and expectation for contacts with other visitors.

Visitor experience also has been consistently found to influence perceived crowding. Experience level is thought to affect normative definitions of crowding either through refinement of tastes (Krutilla 1967; Munley and Smith 1976; Bryan 1977) or by virtue of exposure to lower use levels as a result of earlier participation. The bulk of the empirical evidence supports the notion that more experienced visitors are more sensitive to higher use levels. This appears true regardless of how experience is measured: general experience in the activity, rate of participation, experience on-site, or some other dimension. Two studies of backcountry hikers at Grand Canyon National Park found that repeat visitors have a stronger desire for solitude (Towler 1977; Stewart and Carpenter 1989). Similarly, more experienced hikers on the Appalachian Trail expressed stronger preferences for low-density hiking (Murray 1974).

Characteristics of Other Visitors Encountered
There is considerable evidence that the characteristics of other visitors encountered also influence crowding norms. It seems only reasonable to think
that tolerance for meeting another group would depend, at least to some extent, on its characteristics. Several studies support this view empirically, with the type of group most often defined in terms of mode of travel. Studies in the Boundary Waters Canoe Area Wilderness in Minnesota found that paddling canoeists sharply distinguish among the three types of area users when asked their reactions to meeting other groups (Lucas 1964a,b; Lime 1977a; Stankey 1973; Lewis 1993; Lewis et al. 1996). Canoeists dislike encountering motorboats, are relatively less resentful of encountering motorized canoes, and are relatively tolerant of encountering at least some other paddled canoes. Motor canoeists make similar distinctions, though not as sharply. Thus, canoeists feel crowded at much lower levels of use where motorboats are present.

Other studies also have found differential crowding effects based on mode of travel. Backcountry visitors to Everglades National Park were found substantially more sensitive to meeting other visitors who were traveling by motorboat compared to canoe (Stewart et al. 1991). Visitors to three western wilderness areas were found to have lower tolerances for encountering groups of horseback riders than backpackers (Stankey 1973).

It has also been suggested that party size affects crowding norms (Lime 1972). Considerable support has been found for this notion. For example, most visitors to several wilderness areas reported they would prefer to see five small parties during the day rather than one large party (Stankey 1973).

The behavior of other groups also seems to affect crowding norms. A study of hikers in a national forest, for example, found that other visitors bothered about one-third of the respondents (West 1982). However, probing more deeply, it was found that of this group, the behavior of others bothered the majority, while only a minority was bothered by the number of others encountered. Specific forms of behavior reported as bothering respondents were, in decreasing order: noise, yelling, and loud behavior; littering and polluting lakes; and noncompliance with rules. Respondents exposed to high perceived density (those reporting ten or more contacts) and negative behavior felt crowded nearly half the time, while respondents exposed to high perceived density but not negative behavior felt crowded only a small percentage of the time.

A third characteristic of other groups that seems to affect crowding norms is the degree to which groups are perceived as alike. This factor appears closely related to behavior, but is more difficult to measure. A finding common to all studies of park visitors is that the vast majority of people visit parks in family and/or friendship groups. This suggests the notion of solitude so often associated with certain types of outdoor recreation may not mean simple isolation from other people. It also suggests an inward focus on interpersonal relationships within the social group. Both notions are ultimately important in the concept of alikeness.

Both theoretical and empirical research confirms that solitude in outdoor recreation may have more to do with interaction among group members free from disruptions than with actual isolation (Twight et al. 1981; Hammitt 1982; 31
Hammitt and Patterson 1991; Hammitt and Rutlin 1995). This suggests that as long as contacts with other groups are not considered disrupting they do not engender feelings of crowding or dissatisfaction.

A study of backpackers in Yosemite National Park illustrates the notion of perceptions of alikeness (Lee 1975, 1977). In this study, no relationship was found between perceived crowding and behavioral measures of satisfaction. This finding is attributed to the idea that most social interaction between groups in park and related settings is conducted with little conscious deliberation. People are therefore largely unaware of such social interaction, and it has little effect on perceptions of crowding. The study concludes that the quality of a visitor experience "appears to be closely linked with the opportunity to take for granted the behavior of other visitors," and that "an essential ingredient for such an experience is the assumption that other visitors are very much like oneself, and will, therefore, behave in a similar manner." Thus, to the extent that groups are perceived as alike and require little conscious attention, encounters have limited disruptive effects on intimacy and other dimensions of solitude desired by social groups in park settings.

**Situational Variables**

Finally, the environment in which contacts between visitor groups occur apparently influences, to some extent, the ways in which those contacts are perceived and evaluated. It was suggested very early in crowding research that there are inter-area differences in crowding norms (Clawson and Knetsch 1966). Hypothetical curves relating the effects of level of use to the quality of the visitor experience were seen as taking dramatically different shapes for three types of parks and related areas: wilderness, an unimproved campground, and a highly developed campground. That different use levels are appropriate for different types of parks seems obvious in a conceptual way, though not much is known about the issue in a quantitative sense. Some empirical evidence is offered by a study of use level crowding relationships among visitors to seashore beaches (McConnell 1977). Different relationships were found at different types of beaches ranging from a natural area to a highly developed "singles" beach. Similarly, a study of river recreationists found different patterns of desired use levels among users of six river types ranging from primitive to urban (Manning and Ciali 1981).

More focus has been placed on intra-area differences in crowding norms. Visitors to wilderness areas, for example, are more sensitive to crowding at campsites than along trails (Burch and Wenger 1967; Stanley 1973, 1980; Lime 1977a; Lucas 1980). Heightened sensitivity to encounters also has been found in the interior of wilderness as opposed to the periphery (Stanley 1973; Stanley et al. 1976; Lime 1977a; Lewis 1993). Given the choice, most wilderness visitors preferred encounters to occur within the first few miles of the trailhead rather than in interior zones.

Finally, it also has been suggested that crowding may depend to some extent on the physical, nonhuman environment (Hammitt 1983). An area might be perceived as crowded, for example, because the amount and configuration of facilities prohibit a visitor from functioning as desired, even when only a small
number of visitors are present. This issue has received little research attention, though a study of crowding in a developed campground in Katmai National Monument is suggestive (Womble and Studebaker 1981). This study found very little relationship between level of use and perceived crowding. However, the study went on to use an open-ended comments section of the questionnaire to identify other factors which might account for an unexplained variance in crowding perceptions. Several factors were identified, the most important of which were proximity of campsites and insufficient facilities. This suggests design aspects of the recreation environment may be involved in normative definitions of crowding.

A related consideration is the perceived environmental quality of parks. A study of visitors to the Dolly Sods Wilderness Area, West Virginia, created an index of perceived environmental disturbance (Vaske et al. 1982). The index consisted of six items for which respondents rated perceived conditions as worse than, about the same as, or better than expected. Some respondents rated conditions worse than expected, and this had a substantive effect on perceived crowding. When the perceived environmental disturbance index was added to measures of reported, preferred, and expected contacts, the amount of variance explained in perceived crowding rose substantively. Moreover, the environmental disturbance index had the largest effect on perceived crowding of any of the four independent variables. These findings indicate that perceived crowding is influenced not only by the physical presence of others, but also by the environmental impacts left by previous visitors. These findings are consistent with other studies which indicate the presence of litter or other environmental degradation often disturbs park visitors more than contacts with other visitor groups (Stankey 1973; Lee 1975; Lucas 1980; Anderson and Brown 1984).

Coping Behaviors

A second approach to understanding crowding in parks and related areas concerns coping behaviors. Coping behaviors are cognitive or overt actions visitors can adopt to deal with perceived crowding. Two basic categories of coping behaviors have been studied: cognitive mechanisms and displacement.

Cognitive coping mechanisms concern how visitors think about parks and related areas and, in particular, how this thinking might change in light of increasing use levels and perceived crowding. Three types of cognitive coping mechanisms have been identified: site succession, product shift, and rationalization. Site succession is a process by which visitor norms for appropriate use levels might change over time in response to increasing use levels. That is, as use levels of parks and related areas grow over time, visitors may adapt by simply accepting these higher use levels as inevitable. Through this process, new, higher crowding norms may evolve over time.

Product shift is related to site succession, but involves a redefinition of the recreation experience by the visitor. That is, as use levels grow over time, visitors may feel that they are now experiencing a "developed recreation area" at what was once a "wilderness area." They have not necessarily changed their

Crowding and Carrying Capacity in Parks
normative expectation for appropriate use levels of wilderness areas (as is the case for site succession); they have simply accepted that the recreation experience provided by a particular area has changed and the use levels now encountered at that area are in accordance with that new type of experience.

Rationalization is a third type of cognitive coping mechanism. Since recreation activities are voluntarily selected and often involve a substantial investment of time, money, and effort, visitors may be inclined to report high levels of satisfaction regardless of conditions experienced. This coping mechanism is rooted in the theory of cognitive dissonance which suggests that people order their thoughts in ways that reduce inconsistencies and associated stress (Festinger 1957). This may help explain why visitor satisfaction tends to remain high over time despite increasing use levels.

Displacement is the second coping strategy hypothesized in outdoor recreation. Displacement is a behavioral rather than cognitive coping mechanism because it involves overt action by visitors. A number of studies have suggested that as use levels increase over time, some visitors become dissatisfied and alter their patterns of use to avoid crowding. These changes in use patterns may include both spatial and temporal dimensions of use. In this manner, some visitors may be displaced by visitors who are more tolerant of higher use levels.

Several studies have empirically explored coping mechanisms. A study of boaters at the Apostle Islands National Lakeshore in Wisconsin examined changes in boating use patterns over a ten-year period (Kuentzel and Heberlein 1992). This was done by a survey of boaters in 1975 and surveying the same group again in 1985. This study found that a relatively large number of boaters had adapted intrasite displacement strategies. That is, they had shifted their use of the park to areas that were not as heavily visited. A study of backpackers in Great Smoky Mountains National Park also found considerable evidence of both intrasite and temporal displacement (Hammitt and Patterson 1991). A large number of visitors reported choosing different trails and campsites and shifting their visits to alternative times (e.g., weekdays, off-season) to avoid encounters with others.

A slightly different methodology was applied in a study of visitors to the Boundary Waters Canoe Area Wilderness, and indications of displacement were again found (Anderson 1980, 1983; Anderson and Brown 1984). Visitors who had made more than four trips to the area were studied to determine changes in trip patterns over time. The vast majority of respondents were found to have changed their pattern of use by selecting different entry points or campsites, or entering on a different day of the week. Factors related to trip changes included use level, litter, noise, and environmental impacts. A similar study of boaters using the Apostle Islands National Lake Shore (Vaske et al. 1980) found that boaters whose first trip to the area had occurred earlier evaluated existing contact levels more negatively than those whose first trip had occurred more recently and also more frequently avoided the heavier used islands.

Several other studies of coping mechanisms have been conducted in a variety of outdoor recreation areas (Neilson and Shelby 1977; Stankey 1980; Becker)
1981; Becker et al. 1981; Neilson and Endo 1977; Wohlwill and Heft 1977; Hammitt and Hughes 1984; Manning and Ciali 1980; Robertson and Regula 1977; Shelby et al. 1988a; Shindler and Shelby 1995). Generally, these studies have found some support for displacement (intrasite, temporal, and intersite) and product shift strategies.

Satisfaction as a Dependent Variable

A final approach to understanding crowding in parks and related areas concerns the shortcomings of overall trip satisfaction as a dependent variable. These shortcomings arise for two major reasons. First, visitor satisfaction is a global, multidimensional concept. It is unlikely that any one independent variable, such as level of visitor use, would affect such an all-encompassing dependent variable. Indeed, the empirical research on crowding tends to support this view.

As noted earlier, few statistically significant relationships have been found between the level of visitor use and overall trip satisfaction. Even the more directly relevant measure of perceived crowding explains relatively little of the variance in visitor satisfaction. For example, studies of backcountry hikers in Yosemite National Park and rafters on the Colorado River in Grand Canyon National Park found little or no relationship between perceived crowding and overall trip satisfaction of visitors (Lee 1975; Shelby 1980). Both studies went on to identify a number of diverse variables which were correlated with visitor satisfaction, including absence of litter and other pollution, level of facility development, pleasant social demeanor of others, and good physical condition of trails. However, all these variables together failed to explain most of the variance in visitor satisfaction.

Additionally, most studies found park visitors tend to report consistently high levels of satisfaction. This may be because recreation and leisure activities, almost by definition, are self-selected. That is, visitors try to select recreation activities and locations which they believe will fulfill their expectations. This may be especially true in the National Park System. A recent study of visitors to eight NPS areas, including natural, cultural, recreational, and urban areas, found that average ratings of visitor satisfaction (on a scale of 10 = highest, 1 = lowest) ranged only from a high of 9.1 to a low of 8.4 (Kornblum 1991). Clearly, the vast majority of visitors to NPS areas are highly satisfied in a general, overall sense, despite what specific concerns they may have about certain aspects of their experience. Research suggests that park visitors even select activities and locations within parks which they believe will fulfill their expectations. For example, backcountry hikers in Grand Canyon National Park who had strong desires for solitude were found more often in low use zones (Stewart and Carpenter 1989). Thus, it should not be surprising that most visitors tend to report high levels of trip satisfaction.

Summary

Intuition suggests as use levels of parks and related areas increase, visitors are subject to crowding and become dissatisfied. However, a number of studies found little statistical relationship between use levels and overall trip satisfaction. A series of follow-up studies has shown that crowding in parks
and related areas is more complex than originally thought. Crowding is best understood as a normative concept. That is, visitors have beliefs or standards about appropriate use levels in parks and related areas, and crowding occurs when these standards are violated. However, crowding norms are influenced or mediated by a variety of factors, including personal characteristics of visitors, the characteristics of other visitors encountered, and the situation or context in which encounters occur. Moreover, visitors can adopt a variety of cognitive and behavioral coping mechanisms to deal with crowding. Finally, overall trip satisfaction is too general a measure to manage crowding because crowding is only one of many variables which might influence visitor satisfaction.

The research on crowding suggests crowding is an important issue that must be managed in parks and related areas. Many visitors have normative expectations about appropriate use levels in parks and related areas. If these norms are violated, perceived crowding will result. Research suggests visitors who are less tolerant of higher use levels may be displaced from parks and related areas, or forced to adopt other coping behaviors. If use levels are not managed appropriately, perceived crowding will increase, and some (potentially many) visitors ultimately will be displaced.

From Crowding to Carrying Capacity

The Concept of Carrying Capacity

Concern over crowding and related issues has led to development of the concept of carrying capacity. Indeed, much has been written about the carrying capacity of the National Park System and other areas. The underlying concept of carrying capacity has a rich history in the natural resource professions. In particular, it has proven a useful concept in wildlife and range management where it refers to the number of animals of any one species that can be maintained in a given habitat (Dassmann 1964). Carrying capacity has obvious parallels and intuitive appeal in the field of park management. In fact, it was first suggested, in the mid-1930s, as a park management concept in the context of the National Park System (Sumner 1936). However, the first rigorous applications of carrying capacity to park planning and management did not occur until the 1960s.

These initial, scientific applications of carrying capacity to park management suggested the concept was more complex in this new management context. At first, as might be expected, the focus was placed on the relationship between visitor use (numbers of people) and environmental conditions. The working hypothesis was that increasing visitor use causes greater environmental impact as measured by soil compaction, destruction of vegetation, and related variables. It soon became apparent, however, that there was another dimension of carrying capacity dealing with social aspects of the visitor experience. An early and important report on the application of carrying capacity to parks and related areas, for example, reported the study.

Crowding and Carrying Capacity in Parks
"... 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).

The point was that as more people visit an area, not only can the environmental resources of the area be affected, but so too can the quality of the visitor experience. Again, the working hypothesis was that increasing visitor use causes greater social impact as measured by crowding and related variables. Thus, as applied to areas comprising the National Park System—monuments, historic sites, lakeshores, rivers, battlefields, and memorials—carrying capacity had two components: environmental and social.

More recently, it has become evident that carrying capacity has a third component as well. The carrying capacity of an area within the National Park System can vary according to the amount and type of management activity applied. For example, the durability of environmental resources might be enhanced through fertilizing and irrigating vegetation, periodic rest and rotation of sites, and designating and developing "hardened" visitor facilities. Similarly, the quality of the visitor experience might be maintained or even enhanced in the face of increasing visitation by means of more even distribution of use, appropriate rules and regulations, provision of additional visitor facilities, and educational programs designed to encourage desirable visitor behavior. Thus, carrying capacity is not necessarily fixed, but can be adjusted, at least to some degree, through management.

Based on this discussion, carrying capacity is most appropriately viewed as a three-dimensional concept (figure 1). Each of these three components must be taken into account when determining the carrying capacity of an area within the National Park System. The emphasis of this paper is on the social component of carrying capacity.

Social Carrying Capacity

The early scientific work on carrying capacity has blossomed into an extended literature base on social aspects of outdoor recreation and their application to carrying capacity (e.g., Stankey and Lime 1973; Manning 1986; Kuss et al. 1990; Shelby and Heberlein 1986). But despite the impressive literature base, efforts to determine and apply social carrying capacity to areas such as the National Park System have often resulted in frustration. The principal difficulty lies in determining how much social impact, such as crowding, is too much. Given the substantial demand for public use of national park areas, some decline or change in the quality of the visitor experience (e.g., some perceived crowding) is inevitable. But how much decline or change is appropriate or acceptable? This issue is often referred to as the "limits of acceptable change" and is fundamental to social carrying capacity determination (Lime 1970; Frissell and Stankey 1972).
This issue is illustrated graphically in figure 2. In this figure, two hypothetical relationships between visitor use and crowding are shown. It is clear from both that visitor use level and perceived crowding are related: increasing numbers of visitors cause increasing percentages of visitors to report feeling crowded. However, it is not clear at what point carrying capacity has been reached. The relationships in figure 2 illustrate that some crowding is inevitable given even relatively low levels of visitor use. Thus, some level of crowding must be tolerated if national parks are to remain open for public use. For the relationship defined by line A, $X_1$ and $X_2$ represent alternative levels of visitor use that result in alternative levels of crowding as defined by points $Y_1$ and $Y_2$, respectively. But which of these points—$Y_1$ or $Y_2$, or some other point along this axis—represents the maximum amount of crowding that is acceptable?

To emphasize and further clarify this issue, some writers have suggested distinguishing between descriptive and evaluative components of social carrying capacity determination (Shelby and Heberlein 1986). The descriptive component of social carrying capacity focuses on factual, objective data such as the relationships in figure 2. For example, what is the relationship between the amount of visitor use and visitor perceptions of crowding? The evaluative component of social carrying capacity determination concerns the seemingly more subjective issue of how much impact or change in the recreation experience is acceptable. For example, what level of perceived crowding should be allowed before management intervention is appropriate?
Visitor Use

Figure 2. Hypothetical relationships between visitor use and crowding.

**Management Objectives and Indicators and Standards of Quality**

Recent experience with carrying capacity suggests answers to the above questions can be found through formulation of management objectives and development of indicators and standards of quality (Graefe et al. 1990; NPS 1992; Shelby et al. 1992; Stankey et al. 1985; Stankey and Manning 1986). This approach to carrying capacity focuses principal emphasis on defining the type of visitor experience to be provided and then monitoring conditions over time to assess whether acceptable conditions have been maintained.

Management objectives are broad, narrative statements defining the type of visitor experience to be provided. They are based on review of the purpose and significance of the area under consideration. Formulation of management objectives may involve review of legal, policy, and planning documents, consideration by an interdisciplinary planning/management team, and public involvement.

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 both the physical and social environment that are important in determining the quality of the visitor experience. Standards of quality define the quantitative and measurable condition of each indicator variable.

By defining indicators and standards of quality, carrying capacity can be determined and managed through a monitoring program. Indicators of quality can be monitored over time and once standards have been violated, carrying capacity has been reached. This approach to carrying capacity is central to contemporary park planning frameworks, including Limits of Acceptable

Crowding and Carrying Capacity in Parks

A Normative Approach to Standards of Quality

Not surprisingly, one of the most problematic issues in this contemporary approach to carrying capacity has been setting standards of quality. Such standards may be based on a variety of sources, including legal and administrative mandates, agency policy, historic precedent, expert judgement, interest group politics, and public opinion, especially that derived from park visitors. This latter source has special appeal as it involves those most directly interested in and affected by carrying capacity decisions and related management actions.

Research on visitor-based standards of quality has increasingly focused on personal and social norms. Developed in the fields of sociology and social psychology, norms have attracted considerable attention as an organizing concept in outdoor recreation research and management. In particular, normative theory has special application to setting standards of quality for the visitor experience. Norms are generally defined as standards that individuals and groups use for evaluating behavior and social and environmental conditions (Donnelly et al. 1992; Shelby and Vaske 1991; Vaske et al. 1986). If visitors have normative standards concerning relevant aspects of recreation experiences, then such norms can be studied and used as a basis for formulating standards of quality. In this way, carrying capacity can be determined and managed more effectively.

Application of norms to standards of quality in outdoor recreation is most fully described by Shelby and Heberlein (1986) and Vaske et al. (1986). These applications have relied heavily upon the work of Jackson (1965), who developed a methodology—return potential curves—to measure norms. Using these methods, the personal norms of individuals can be aggregated to test for the existence of social norms or the degree to which norms are shared across groups. Normative research in recreation has focused largely on the issue of crowding (e.g., Heberlein et al. 1986; Patterson and Hammitt 1990; Shelby 1981; Vaske et al. 1986; Whittaker and Shelby 1988; Williams et al. 1991; Manning et al. 1995a; Manning et al. 1996c,d; Hall and Shelby 1996; Shelby and Heberlein 1986; Lewis et al. 1996), but also has been expanded to include other potential indicators of quality, including ecological impacts (Shelby et al. 1988b; Manning et al. 1995a; Manning et al. 1996b), wildlife management practices (Vaske and Donnelly 1988), and minimum stream flows (Shelby and Whittaker 1990).

Applying Carrying Capacity in the National Park System: Visitor Experience and Resource Protection

The NPS has long recognized the need to apply the concept of carrying capacity. The 1978 General Authorities Act (US Congress 1978) requires each

Crowding and Carrying Capacity in Parks
park's general management plan to include "identification of and implementation commitments for visitor carrying capacities for all areas of the unit" (P.L. 95-625). Although NPS management policies and planning guidelines acknowledge this responsibility, there has been little direction or agreement on a methodology to identify a park's carrying capacity. Indeed, agency-wide agreement on the meaning of the term "carrying capacity" has been lacking. Park managers are often uncomfortable saying that their parks, or areas within their parks, are receiving inappropriate or excessive use, because they lack the data and rationale needed to make these often controversial decisions.

In response to this problem, NPS planners, managers, and researchers have been developing a process to make decisions about carrying capacity. This process is called Visitor Experience and Resource Protection (VERP).

In keeping with the discussion of carrying capacity in the previous section of this paper, VERP interprets carrying capacity not so much as a prescription of numbers of visitors, but as a prescription of desired social and ecological conditions. Based on these desired conditions, the process identifies and documents the kinds and levels of visitor use deemed appropriate, as well as where and when such visitor use should occur. The prescriptions, coupled with a monitoring program, give park managers the information and the rationale needed to make better decisions about visitor use, and gain the public and agency support needed to implement those decisions.

VERP is similar to other carrying capacity-related frameworks such as LAC and VIM, described earlier. All of these frameworks include a description of desired future conditions, identification of indicators of quality experiences and resource conditions, establishment of standards that define minimum acceptable conditions, and monitoring to determine if and when management action must be taken to keep conditions within acceptable standards.

Management of visitor use begins with a plan, but this is only a starting point; it continues as an iterative process for monitoring, evaluation, and adjustment.

Discussions about the appropriate focus and scope of VERP efforts have led to the following working definition of the VERP framework:

"VERP is a planning framework that focuses on protecting the quality of visitor experiences and the integrity of park resources. Threats to protecting these qualities are primarily attributable to visitor use levels, visitor behavior, types of use, timing of use, and location of use."

The VERP Framework

Nine elements are integral to the VERP framework which are summarized below. While the scope of the elements, the order in which they are undertaken, and the specific methods used to complete elements may vary in different situations, all of the elements are necessary to implement a VERP program.

Although the elements are numbered and may appear to follow a linear process, it is important to remember that the VERP framework is iterative, with feedback and feed-forward occurring throughout the elements.
**Element 1: Assemble an interdisciplinary project team**
A core team is needed, comprised of those people who can develop the plan and those who will implement the plan. A wide variety of consultants with various backgrounds and expertise may be needed to assist the core team.

**Element 2: Develop a public involvement strategy**
Just as in any planning effort, the public must be involved in VERP planning. Both NPS staff and publics external to the agency should be considered. A public involvement strategy should be prepared early in the framework.

**Element 3: Develop statements of park purpose, significance, and primary interpretive themes; identify planning mandates and constraints**
These statements form the foundation upon which the VERP plan and implementation strategies are built. All subsequent elements must be consistent with and supportive of these statements. This element may already exist in many parks, having been developed in previous planning efforts. But if this work has not been done, VERP work should not continue until all of these statements are articulated and clearly understood.

**Element 4: Analyze park resources and existing visitor use**
The objective of this element is to gather and analyze information on the park’s resources and existing visitor uses and experience opportunities. This analysis should be documented, usually through a combination of maps, matrices, and text.

**Element 5: Describe a potential range of visitor experience opportunities and resource conditions (potential prescriptive zones)**
Potential zones are described by different desired visitor experience opportunities and resource conditions that could be provided in a given park, consistent with the park’s purposes and significance. The zone descriptions prescribe appropriate kinds and levels of activity, development, and management. These potential zones are described in text only; they are applied to specific geographical areas in element 6.

**Element 6: Allocate the potential zones to specific locations within the park (prescriptive management zoning)**
In this element the potential zones described in element 5 are assigned to specific locations within a park. The zoning scheme prescribes desired future conditions; it is not descriptive of existing conditions (although in some cases the continuation of existing conditions could be the desired future). If appropriate, the planning team should develop alternative zoning schemes and assess their beneficial and adverse impacts, consistent with the National Environmental Policy Act.

**Element 7: Select indicators and specify standards of quality for each zone; develop a monitoring plan**
Indicators of quality (specific, measurable variables that will be monitored) and standards of quality (minimum acceptable conditions) are identified for each zone. The purpose of this activity is to identify measurable resource and social variables that indicate whether a desired condition is being met. This is a pivotal element that defines the zones, transforming subjective descriptions into...
objective measurements of conditions in those zones. A monitoring plan is
developed that identifies priorities, methods, funding and staffing strategies,
and analysis requirements.

**Element 8: Monitor resource and social indicators**

Park staff regularly monitors resource and visitor experience conditions in
various zones. Staff and funding limitations will usually necessitate setting
priorities and monitoring only in the most critical areas. Through monitoring
the park staff compares existing conditions to specified standards of quality.
Each zone is assessed to determine if there are discrepancies with the desired
resource and social conditions, or trending in that direction.

**Element 9: Take management actions**

When monitoring indicates that visitor experiences or resource conditions are
out of standard or trending in that direction, management actions must be taken
to improve the situation. This element initially consists of identifying the
probable causes of discrepancies in each zone. Identifying accurately the root
causes of any discrepancies is important in this element. Herein the park staff
identifies management strategies to address discrepancies. Visitor use
management prescriptions should start with the least restrictive measures that
will accomplish the objective and move toward more restrictive measures if
needed.

The VERP framework was primarily conceived and designed to be part of the
park general management planning process. Indeed, many of the elements in
the VERP framework should be part of each park’s general management plan.
However, there are other situations where VERP may be applied outside of the
general management planning process. For example, it may be necessary at
times to address visitor use issues for parks with existing general management
plans or to address visitor use issues in only one or two areas within a park. A
separate visitor management plan or an amendment to an existing plan may be
appropriate in these cases.

**A Pilot Application of VERP**

VERP was recently pilot-tested at Arches National Park, Utah. The purpose of
this test application was to refine the VERP process and provide a model for
application to the National Park System. A program of research was designed
and conducted to assist in this pilot application. The primary purpose of this
research was to help formulate indicators and standards of quality. The social
science component of this research program is described in the remainder of this
section.

Arches National Park comprises 29,000 ha of high-elevation desert with
outstanding slick rock formations, including nearly 2,000 stone arches. Most of
the park’s scenic attractions are readily accessible through a well-developed
road and trail system. Visitation to Arches has been increasing rapidly. The
number of visits increased 91 percent in the decade of the 1980s and the park
received more than three-quarters of a million visits in 1995.

The social carrying capacity research program at Arches was approached in two
phases. Phase I, conducted in the summer of 1992, was aimed at identifying

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*Crowding and Carrying Capacity in Parks*
potential indicators of quality of the visitor experience (Manning et al. 1993). Personal interviews were conducted with 112 visitors throughout the park. In addition, another 83 people expressed their views during ten focus group sessions held with park visitors, park staff, and local community residents. Respondents and participants were selected through a purposive rather than random sampling procedure. Thus, data are primarily qualitative in nature. This exploratory effort was to begin learning about a variety of human-use aspects of visitation to Arches and to develop insights into potential indicators of the quality of the visitor experience. Interviews and focus group sessions were guided by a standardized questionnaire.

The questionnaire contained two major sections that focused on identifying potential indicators of the quality of the visitor experience. The first section contained a battery of open-ended questions that probed for park conditions and issues that visitors and others considered important to determining the quality of the park experience. The second section of the questionnaire contained a battery of close-ended questions that also probed for indicators of quality. Fifty-three wide-ranging park conditions or issues were presented to respondents who were asked to indicate whether each item was considered a "big problem," a "small problem," or "not a problem"; a "no opinion" option was also included. The items presented were developed based on literature review, discussion with park planners and staff, and personal observations in the park.

Responses to the battery of open-ended questions were coded into 91 categories. These categories were then grouped into eight similar subject matter classes or issues: (1) information/education, (2) facilities, (3) crowding, (4) visitor behavior and activities, (5) resource impacts, (6) park management actions, (7) natural features of the park, and (8) miscellaneous. Apparently, a variety of issues were important in determining the quality of the park experience. Beyond this diversity, however, there was some consensus.

Good information, education, and interpretive facilities and services were often cited as contributing to the quality of the visitor experience, and relatively large numbers of visitors expressed a desire for more such programs. Many visitors sampled felt knowing about the availability and location of visitor opportunities within the park and learning more about the significance of park resources were important. An especially important theme of information and education efforts concerns the importance and knowledge of how to reduce visitor-caused impacts to park resources. For example, the opportunity to interact directly with a ranger through an interpretive program or informal conversation in the park is important to many visitors, and they frequently expressed the need for this activity to be expanded in the park.

Many respondents also cited facility-related issues. Many respondents found the hiking trails to their liking and appreciated the extent to which many major attractions were readily accessible. Visitor attitudes about other activity-related issues were more divided. The primary facility need appears to be more vehicle-accessible campsites. Visitors suggested a host of other facilities, but only a small minority of visitors mentioned each facility. This desire for
additional facilities was offset by a number of visitors who liked the general lack of facilities (or at least, commercial facilities) or felt that no additional facilities should be developed in the park.

Many visitors contacted were concerned with crowding-related issues in the park. Twenty percent of respondents felt generally that there were "too many people in the park." Smaller numbers reported some degree of crowding in selected locations such as parking lots, certain attraction sites (primarily at arches), and trails.

Respondents expressed concern about a large variety of inappropriate visitor activities and behaviors. The most important of these behaviors was the objection to visitors walking off designated trails.

Considerable visitor concern was focused on a variety of issues related to the resource impacts of public use. Relatively large numbers of respondents noticed and objected to resource impacts caused by off-trail hiking, litter, and graffiti on rock walls.

Relatively few visitors mentioned issues related to park management activities. The most frequently mentioned issue was that visitors found the park to be well maintained with a lack of visually obtrusive development and that this contributed to the quality of their experience. For example, an especially positive condition was the general lack of signs and guard rails along park roads which, when present, detract from the visual quality of the setting.

Finally, the most frequently offered comment was enjoyment and appreciation of the park's natural features, including the arches and the general scenery. While this is not surprising, it suggests that some indicator variable(s) be developed and monitored to ensure this opportunity is not diminished through damage to outstanding natural features or through facility development that detracts from their prominence or appreciation, or diminishes atmospheric visibility.

Responses to the close-ended questions also indicated some widely shared concerns important to the quality of the park experience. A majority of respondents rated 14 of the 53 issues as a "small" or "big" problem. These 14 issues clustered into five categories:

1. Respondents reported considerable concern over visitors walking off trails and otherwise engaging in behaviors which caused damage to park resources. Most respondents felt the following issues were a small or big problem: "people walking off the trails," "people walking off the trails causing damage to soils and vegetation," "vandalism to rocks and other natural features in the park," "damage to soil and vegetation caused by visitors," "lack of knowledge by visitors about proper behavior in the park," and "lack of Park Service programs to educate visitors about proper behavior in the park."

2. Respondents expressed concern about selected aspects of crowding in the park. Most respondents felt the following issues were a small or big problem: "too many people on the trails," "too many people at major

Crowding and Carrying Capacity in Parks

45
attractions (e.g., Windows, Devils Garden, Delicate Arch),” and “lack of parking at major attractions (e.g., Windows, Devils Garden, Delicate Arch).”

3. Respondents expressed some concern over a perceived lack of rangers in the park. Most respondents felt the following issues were a small or big problem: “lack of rangers to talk to on trails” and “lack of rangers to talk to.”

4. Respondents expressed concern over two facility-related issues. Most respondents felt the following issues were a small or big problem: “too few campgrounds in the park” and “lack of drinking water.”

5. Respondents expressed some concern over a perceived lack of public education programs in the park. Most respondents felt the following issue was a small or big problem: “lack of educational signs/exhibits.”

Findings from the exploratory research in 1992 provided important insights into park conditions and issues which add to or detract from the quality of the visitor experience at Arches National Park. Potential indicators of quality range widely, spanning a variety of categories, including:

1. Orientation, information, and interpretive services
2. Visitor facilities
3. Visitor crowding
4. Visitor behavior and activities
5. Resource impacts of visitor use
6. Park management activities
7. Quality and condition of natural features

Phase II of the research program was conducted in 1993 (Lime et al. 1994). The primary objectives of this phase of the research were to determine the relative importance of indicator variables, to assist in setting standards of quality for selected indicator variables, and to guide development of a visitor management program. A survey of park visitors was conducted in the summer and fall of 1993 at several locations throughout the park. The survey was administered to a representative sample of park visitors and was conducted by both personal interviews and mail-back questionnaires.

The survey instruments contained three major sections related to carrying capacity. The first section focused on determining the relative importance of indicator variables identified in Phase I research. Fourteen indicator variables were distilled from the previous phase of research, and respondents were asked to rate the importance of each variable in determining the quality of their experience at the particular location in the park where they were interviewed. This section of the questionnaire was needed for two reasons. First, Phase I research was qualitative in nature; its purpose was simply to explore for potential indicator variables. Phase II research had to be quantitative: respondents were asked to rate the relative importance of these potential indicators of quality. This required a larger and more representative sample. Second, investigators hypothesized that indicator variables might vary by
location within the park. Sampling was conducted in all of the major zones within the park, and questions were keyed directly to those specific areas. Study findings helped identify the most important indicator variables. Several statistically significant differences were found among zones. These findings helped identify the indicator variables which were selected for each zone.

The second major section of the survey questionnaires was directed at determining standards of quality for selected indicator variables. Three indicator variables received special attention: (1) the number of people at one time at major attraction sites within the park, (2) the number of people at one time along trails, and (3) the amount of environmental impact to soil and vegetation caused by off-trail hiking. All three variables were addressed by a series of photographs illustrating a range of impact conditions. Photographs were developed using a computer-based image capture technology (Pitt 1990; Lime 1990; Nassauer 1990; Chenoweth 1990). Base photographs of park sites were taken and these images were then modified to present a range of impact conditions. A set of 16 photographs was developed for each attraction site and trail presenting a wide-ranging number of visitors present. An analogous set of photographs was developed for a range of environmental impacts caused by off-trail hiking. Respondents rated the acceptability of each photograph. Representative photographs are shown in figure 3.

Study data were used to help select standards of quality for each zone within the park. The following example illustrates the nature of these data and how they can be used in setting standards of quality. Delicate Arch is a major visitor attraction in the park. Because of its importance and uniqueness, this feature, along with the trail corridor serving it, was established as a separate zone within the park. Study findings suggested that the number of people at any one time at Delicate Arch is an important indicator of quality. Thus, a series of 16 photographs presenting a wide-ranging number of people at one time at this feature (0-108 people) was developed as described above. Figure 4 graphically illustrates respondent ratings of these photographs. The line presented in this figure is a regression line representing the best fit between the number of people in each photograph and acceptability ratings. There is a strong relationship between these variables, with the number of people in the photographs explaining 49 percent of the variance in acceptability ratings ($F < .0001$). The line shown in figure 4 is generally referred to as a social norm curve. Social norms can be useful in formulating standards of quality. This is especially so when, as with Delicate Arch, there is considerable consensus among respondents about the social norm.

The literature on social norms suggests three potential points along the norm curve which might be used to help formulate a standard of quality. The first point is defined as the highest point along the curve, and might be referred to as the optimum. Study findings from Delicate Arch indicate that photograph 1 (figure 3), with no visitors in the scene, is rated as most acceptable; thus, zero people at one time might be considered as a standard of quality. However, this is clearly not feasible given the demand to see this popular feature.
Figure 3. Representative photographs showing (A) increasing levels of visitor use and (B) increasing levels of environmental impact. (Reprinted from Manning et al. 1996d).
The second point is defined as the point at which the norm curve crosses from the acceptable range into the unacceptable range. This might be called the minimum standard of quality. For Delicate Arch, the norm curve crosses into the unacceptable range at 28 people at one time as indicated in figure 4.

The third point is defined by any inflection points along the social norm curve. An inflection point is a point along the norm curve which falls (or rises) especially steeply. Inflection points may represent thresholds of tolerance (or preference) among the sample population. However, there are no inflection points along the norm curve for Delicate Arch.

Given the above findings, a standard of quality of a maximum of 30 people at one time was set for Delicate Arch (NPS 1995). This was based on the figure of 28 people at a time as noted above, but rounded up slightly to reflect the extreme demand to see this important natural feature. Study findings were used to help set other standards of quality throughout the remaining zones in the park.

The third section of the questionnaire asked respondents about their attitudes toward a variety of visitor management actions. VERP, like other carrying capacity frameworks, requires management actions be taken to ensure standards of quality are not violated. To the extent possible, these management actions should be acceptable to visitors. Visitors were asked to respond to a variety of potential management actions within the specific context of the place they were visiting in the park. Respondents were asked to indicate the extent to which they opposed or supported 16 potential management actions. A five-point scale was used, ranging from "strongly oppose" (1) to "strongly support" (5).

Study findings for Delicate Arch are shown in table 1. Five management actions received an average rating of 4.0 or higher, indicating that visitors generally supported these management actions. These management actions are now being implemented (NPS 1995). For example, park staff have enhanced
efforts to educate visitors about appropriate behavior, including staying on designated trails and protecting fragile soils and vegetation. In addition, visitors to Delicate Arch are now required to park at the trailhead in designated parking spaces only. Moreover, the number of parking spaces provided at the trailhead has been designed to help ensure the standard of 30 people at one time at Delicate Arch will not be exceeded.

Table 1. Attitudes of Delicate Arch visitors toward management actions in Arches National Park.

<table>
<thead>
<tr>
<th>Management action</th>
<th>Mean Score*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide more information to visitors concerning appropriate behavior</td>
<td>4.5</td>
</tr>
<tr>
<td>Require visitors to stay on designated trails</td>
<td>4.5</td>
</tr>
<tr>
<td>Require visitors to park only in designated parking spaces</td>
<td>4.4</td>
</tr>
<tr>
<td>Require visitors to learn more about fragile park resources before using this area</td>
<td>4.2</td>
</tr>
<tr>
<td>Require permits for visitors to walk off designated trails</td>
<td>4.2</td>
</tr>
<tr>
<td>Provide more park rangers to enforce park regulations</td>
<td>3.9</td>
</tr>
<tr>
<td>Provide more park rangers to educate and assist visitors</td>
<td>3.9</td>
</tr>
<tr>
<td>Provide more interpretive systems (such as ranger-guided walks)</td>
<td>3.6</td>
</tr>
<tr>
<td>Provide more signs along trails asking visitors to “stay on the trail”</td>
<td>3.5</td>
</tr>
<tr>
<td>Provide more information to visitors concerning the amount of use (number of other visitors) they might encounter</td>
<td>3.5</td>
</tr>
<tr>
<td>Limit the number of people allowed to use this area</td>
<td>3.4</td>
</tr>
<tr>
<td>Limit the amount of parking</td>
<td>3.3</td>
</tr>
<tr>
<td>Construct more rail fences or other barriers to keep visitors on designated trails</td>
<td>2.8</td>
</tr>
<tr>
<td>Provide more parking</td>
<td>2.8</td>
</tr>
<tr>
<td>Develop trails more intensively (such as wider trails, paved surface) to accommodate more visitors</td>
<td>2.3</td>
</tr>
</tbody>
</table>

* 1 = strongly oppose; 2 = oppose; 3 = no opinion; 4 = support; 5 = strongly support

Summary

The concept of carrying capacity has been adapted to manage parks and related areas. Social carrying capacity has emerged as an important dimension of this concept and deals with crowding and related social impacts of visitor use. Contemporary approaches to carrying capacity emphasize the importance of management objectives and, in particular, indicators and standards of quality. Indicators of quality are specific measures of the biophysical, social, or managerial environment that are important in determining the quality of the visitor experience. Standards of quality define the desired condition of each indicator variable. By defining indicators and standards of quality, carrying capacity can be determined and managed through a monitoring system. Standards of quality can be derived from a variety of sources, including the personal and social norms of visitors. Several carrying capacity frameworks have been developed based on the research described above, including LAC and VIM. The NPS has developed a similar carrying capacity framework called VERP. VERP has been pilot-tested at Arches National Park and is being refined and applied at other areas within the National Park System.
Toward a Social Science Research Agenda for Crowding and Carrying Capacity

Research on crowding and carrying capacity has led to development of VERP as a framework for addressing these issues in the National Park System. However, considerable research is needed to continue to refine the VERP process and its application across the National Park System. The remainder of this paper outlines seven areas of high priority research: (1) application of VERP to the range of NPS areas, (2) identification of indicators of quality, (3) setting standards of quality, (4) monitoring indicators of quality, (5) a diversity of NPS visitor opportunities, (6) coping behaviors of current and potential visitors, and (7) management of visitor use. These research priorities are based on review of the crowding and carrying capacity literature and on the deliberations of workshop participants.

Application of VERP to the Range of NPS Areas

Application of carrying capacity to NPS areas should be pursued aggressively. Ever increasing demand for public access to areas managed by the NPS suggests that visitor experiences are likely to change in unknowing and sometimes undesirable ways. Research illustrates that certain types of visitors and experiences are sensitive to crowding and other social impacts and are subject to a variety of coping behaviors, including displacement. Active park planning and management is needed to ensure that units of the National Park System provide a variety of types and levels of visitor use to which they are best suited and designed. The VERP process described in the preceding section should be applied, evaluated, and refined as appropriate in a variety of NPS areas nationwide.

Several potentially useful information needs and/or research questions concerning the application of VERP are:

1. To what extent does VERP and/or other carrying capacity frameworks apply to the variety of management units found throughout the National Park System? Most management and research experience to date concerning carrying capacity has dealt with backcountry or natural resource-based areas. How well do the theories, concepts, and processes developed out of this experience apply to historic and cultural sites, lakeshores, frontcountry, and other types of sites managed by the NPS?

2. What are the best ways to evaluate VERP and/or other carrying capacity frameworks? Such evaluation could be based upon pilot applications to a variety of areas, panels of experts, or other methods. What criteria should be used to judge how well these carrying capacity frameworks function?

Identification of Indicators of Quality

As described earlier, indicators of the quality of visitor experience must be defined to make management objectives fully operational. Indicators are...
specific, measurable variables reflecting the essence or meaning of management objectives. They are quantifiable proxies or measures of the type of visitor experience to be provided and maintained. Indicators may include many types of variables depending upon the kind of visitor experience to be provided.

Research to date on crowding and carrying capacity has focused almost exclusively on backcountry or natural resource-based settings. This type of research should be broadened to include indicators of quality in more heavily developed and visited frontcountry, historical sites, cultural areas, national recreation areas, and urban parks. Preliminary research suggests indicators of quality in other types of park settings may have less to do with the number of contacts between visitor groups, but may be more a function of other physical manifestations of use levels such as traffic congestion, full campgrounds and parking lots, and waiting in lines (Westover 1989; Hammitt et al. 1984).

Several potentially useful information needs and/or research questions concerning indicators of quality are:

1. How well can the quality of the visitor experience be reduced to a set of specific, measurable variables? Do we know enough, or can we learn enough, about the visitor experience to identify and define appropriate indicators of quality?

2. How do planner and manager definitions of appropriate indicators of quality compare with definitions of visitors, commercial tourism providers, and park interest groups? Past research suggests resource managers and visitors, for example, often have very different views. It is not clear to what extent such differences exist for various types of National Park System units.

3. Are there “key” indicators of quality that are relatively constant across all types of park units? Or are there groups of key indicators of quality that are relatively constant across selected types or categories of NPS areas?

Setting Standards of Quality

As described earlier, standards of quality define the quantitative and measurable condition of each indicator variable. Standards may range widely creating a variety of visitor experiences. Research suggests crowding is best understood as a normative process. Therefore, there appears to be considerable potential for a social norm approach to contribute to formulating standards of quality. Social norms are found when visitors, or related subpopulations of visitors, demonstrate substantial agreement about appropriate social conditions of the recreation experience. However, research concerning social norms at NPS areas is, for the most part, preliminary and inconclusive at this time. More research is needed in this area, especially as it may apply to a diversity of indicators of quality as described above.

Several potentially useful information needs and/or research questions concerning standards of quality are:
1. How valid is the social norms concept to visitor use of parks and related areas? As described earlier, the concept of social norms has been borrowed from sociology and sociopsychology. However, there is debate over definition of norms and their application to outdoor recreation (Roggenbuck et al. 1991; Shelby and Vaske 1991; Heywood 1996; Noe 1992; Hall and Shelby 1996). Do visitors to parks and related areas have norms concerning appropriate use levels and other potential indicators of quality?

2. A closely related question concerns the degree to which visitor behavior conforms to visitor norms. In more formal terms, this issue is called “norm congruence.” If visitors do not report perceived crowding when social crowding norms are violated, then this calls into question the validity and usefulness of the social norms concept. Most research to date (Williams et al. 1991; Manning et al. 1996a,c; Lewis et al. 1996) has tended to validate norms through measures of congruence, but findings are not definitive (Patterson and Hammitt 1990).

3. To what extent do visitors or subgroups of visitors agree about norms concerning appropriate use levels? In more formal terms, this issue is often called “crystallization.” Once again, there is some debate in the literature over what constitutes an acceptable level of agreement or crystallization (Roggenbuck et al. 1991; Shelby and Vaske 1991). Moreover, there is debate over how agreement or crystallization should be measured.

4. A closely related question concerns the conditions under which norms can be most appropriately or effectively derived. Preliminary research suggests that visitors are more likely to have norms, and that these norms are likely to be more highly crystallized in backcountry rather than developed areas, for indicator variables that are important (or salient) to them, and for visitors who are more specialized in their recreation activities (Roggenbuck et al. 1991; Shelby and Vaske 1991; Hammitt et al. 1984). However, more research is needed to resolve these issues.

5. How should norms be measured? A number of issues have emerged concerning norm measurement. Norms have traditionally been measured through a narrative format, but visual approaches have recently been adopted to deal with high use situations (Manning et al. 1995a; Manning et al. 1996c,d; Freimund et al. 1995). There also are issues regarding how norm-related questions should be asked, whether respondents should be informed of the management implications of their answers, and whether respondents should be given an option to report that they do not know or do not care about a norm for a particular indicator variable (Roggenbuck et al. 1991; Hall and Shelby 1996; Manning et al. In Press).

6. How do personal and social norms concerning crowding and other indicators of the quality of the visitor experience evolve or change over time? Longitudinal research employing panels and other time series methods should be considered as a way to build on related research (Manning et al. 1995b).
7. Normative research concerning crowding and carrying capacity should continue to address questions about geographic differences within park and recreation settings as well as temporal patterns. For example, studies in Minnesota wilderness suggest that normative consensus might best be associated with site-specific locations such as backcountry travel routes, aggregates of homogeneous features (lakes or rivers) within a travel route, or individual lakes or rivers (Lewis et al. 1996). Such analyses could aid management decisions for specific zones within parks. Similarly, analyses of travel patterns might show, for example, that visitors at a "stationary" location (e.g., a campsite or attraction site) have different normative responses compared to when they are traveling. And, do visitors report different encounter norms depending on whether they are traveling into or out of an area?

Monitoring Indicators of Quality

Monitoring indicators of quality is central to contemporary carrying capacity frameworks, including VERP. Monitoring is needed to trigger management action when and if standards of quality are violated. However, monitoring procedures and programs are not well developed. Moreover, initial experiences with monitoring suggest it can be costly in terms of both personnel and financial resources.

Several potentially useful information needs and/or research questions concerning monitoring are:

1. Information gathering procedures for monitoring should be tested and evaluated to identify strategies that are reliable, cost efficient, and easily operationalized by field personnel. Testing of procedures seems especially needed to compare findings from diverse areas and conditions within the National Park System—parks, historic sites, monuments, lakeshores, etc.

2. The use and application of monitoring data by planners and managers should be assessed. Once field managers have put procedures into use, some effort should be made to evaluate systematically whether or not these efforts justify the time and resources necessary to operate them.

3. What types of indicators of quality can be monitored most efficiently and effectively? Based on this type of information, how can monitoring considerations be integrated into consideration and selection of indicators of quality?

4. What role can geographic information systems (GIS) play as a medium to display information about indicators and standards of quality? Procedures need to be tested as to their application to long-term trend analyses and programs.

5. A closely related question concerns what role monitoring data can serve to inform and educate potential park visitors about park resources, availability of facilities and services, visitor use patterns, and other components of a quality experience. For example, a GIS could be developed to help visualize and display monitoring data in a mapped form. Internet
technology and other forms of electronic communication could then be used to bring this and other information to the public to make informed decisions that match their desires, expectations, and needs (Lime et al. 1996). Formal evaluation by users should assess the application and responsiveness of such systems to their needs. Popular material can be kept and altered to increase service capabilities for users. Less popular material can be modified and further evaluated before deciding to omit it from the system or make large-scale changes.

A Diversity of NPS Visitor Opportunities

It seems clear from studies of crowding and carrying capacity that there is both diversity and unity among visitors to NPS areas. Personal crowding norms can vary widely among visitors suggesting that carrying capacity can be defined in many ways and take many values. However, there also appear to be shared or social norms among relatively homogeneous groups of visitors. This reinforces the notion that NPS areas might best be “zoned” where possible to provide for an appropriate diversity of visitor opportunities. Establishing a diversity of visitor opportunities within the National Park System more fully approaches meeting demands for public access and enjoyment. Moreover, it lessens the burden of NPS managers in choosing among competing visitor groups by allocating some resources for diverse types of visitor opportunities.

This does not mean, of course, that any one NPS area, or indeed the National Park System as a whole, should attempt to provide a full spectrum of visitor opportunities. Rather, each area, or portion thereof, should contribute as best or appropriately as it can to this spectrum. This suggests that visitor opportunities should be planned and managed on a comprehensive or systems basis. That is, each park area should be viewed as part of a larger system of areas. This system may be local, regional, or national depending upon the significance of the area in question.

The notion of diversity in visitor opportunities has been formalized in the literature in terms of the Recreation Opportunity Spectrum (ROS) (Driver and Brown 1978; Clark and Stankey 1979). Perhaps the most significant contribution of the ROS is that visitor opportunities can be defined and described by the three components which comprise the broad concept of carrying capacity: (1) social (e.g., the level of visitor use), (2) environmental (e.g., the degree of naturalness), and (3) managerial (e.g., the intensity of management). Alternative combinations of these factors produce a great range of visitor opportunities. The specific provisions of the ROS need not be adopted formally, but its conceptual foundation provides a useful perspective in planning and managing visitor opportunities in keeping with carrying capacity. It may be productive to research and develop a spectrum of recreation opportunities (or zones) which can be applied to areas within the National Park System.

Several potentially useful information needs and/or research questions concerning the diversity of NPS visitor opportunities are:
Can a standardized zoning or ROS-type system for describing visitor opportunities be developed for the National Park System—or for selected types of NPS areas?

If each area of the National Park System is to be planned and managed as part of a larger system of areas, how are such systems defined? In other words, how are local, regional, or national boundaries drawn to form meaningful systems of park areas?

Are the three components of carrying capacity—social, environmental, and managerial—appropriate to defining the diversity of visitor opportunities across the National Park System?

Coping Behaviors of Current and Potential Visitors

As described earlier, coping behaviors are cognitive or overt actions visitors can adopt to deal with perceived crowding. Coping behavior is one of the theoretical reasons why there is often only a weak statistical relationship between use level and visitor satisfaction. Displacement is the most frequently cited example of a coping behavior. Displacement suggests that visitors who are sensitive to increased use levels (i.e., have low crowding norms) seek out alternative locations or times where or when use levels are lower. In this sense, these visitors are displaced by visitors who are less sensitive to increasing use levels or certain types of use (i.e., have higher crowding norms).

Several potentially useful information needs and/or research questions concerning coping behaviors are:

1. To what extent is visitor displacement a problem in the National Park System? What social impacts are responsible for visitor displacement? Can carrying capacity determination (including VERP, indicators and standards of quality) and zoning or ROS-type approaches be used to help manage visitor displacement?

2. Would a regional or national study approach be useful in analyzing visitor displacement? If visitors are being displaced from selected NPS areas, are substitute areas available? What is the general pattern of displacement?

3. Are general population studies needed to address the issue of visitor displacement? If certain segments of the population have been displaced from the National Park System, then a general population study (rather than onsite studies) may be appropriate to contact these displaced visitors.

4. To what extent are cognitive coping behaviors employed by visitors to NPS areas? If visitors are employing a product shift strategy, does this mean the National Park System increasingly is providing more highly developed areas in the minds of most visitors? If a site succession strategy is being employed, does this mean that NPS areas can accommodate ever increasing levels of visitor use?

Crowding and Carrying Capacity in Parks
Management of Visitor Use

Research on crowding and carrying capacity strongly suggests the need for visitor use management. To the extent that visitors have personal and social crowding norms, use levels must be managed so as not to exceed these norms. Moreover, contemporary carrying capacity frameworks, including VERP, are structured around indicators and standards of quality. These carrying capacity approaches require explicit management action if and when standards of quality are violated. While some conceptual and empirical research has been conducted on management of visitor use, it is limited and sporadic. The literature suggests a considerable variety of potential visitor use management actions. Indeed, a recent study identified more than 100 management actions used to control visitor use in NPS backcountry areas (Marion et al. 1993; Manning et al. 1996b). Moreover, these management actions can be classified by their strategic purpose (Manning 1979, 1986) and by their directness (Peterson and Lime 1979; Lime 1977b,c, 1979).

Several potentially useful information needs and/or research questions concerning management of visitor use are:

1. How can the potential diversity of visitor management practices and actions best be organized and presented to managers? It is important that managers be explicitly aware of the diversity of visitor use management actions available to them. Moreover, they should be aware of the potential advantages and disadvantages of each management action.

2. What is the potential effectiveness of visitor use management actions? As discussed throughout the collection of papers in this volume, while some research has been conducted in this area, it is spotty and inclusive. For example, research shows that providing information and education to visitors can influence use patterns and visitor behaviors (e.g., Lime and Lucas 1977; Roggenbuck and Berrier 1981, 1982; Echelberger et al. 1983). Park entrance and use fees also have been shown to influence visitor use (e.g., Willis et al. 1975; Manning et al. 1984; Bamford et al. 1988). However, this and related research are far from comprehensive.

3. Studies to evaluate various visitor management strategies and tools are especially needed in frontcountry areas, in natural resource settings, cultural sites, historic areas, and urban locations. What limited research there has been in this area has focused on backcountry. Results from these studies should not be considered transferable without further inquiry and evaluation.

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Crowding and Carrying Capacity in Parks


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Crowding and Carrying Capacity in Parks 59


Crowding and Carrying Capacity in Parks


Crowding and Carrying Capacity in Parks


Crowding and Carrying Capacity in Parks
Alleviating Congestion in Parks and Recreation Areas Through Direct Management of Visitor Behavior

Stephen F. McCool and Neal A. Christensen

Introduction

Clearly, a continuing dilemma for managers of national park amenity resources is identifying and implementing techniques for effectively reducing congestion. Literally thousands of studies have examined perceptions of crowding, linked perceptions to satisfactions, and assessed preferences of users for techniques to address these problems. It is surprising, therefore, that this issue would continue to perplex managers. Most managers should be aware of the array of techniques to address congestion problems—from education to zoning, use limits to information, closures to fees, barriers to enforcement. Yet, our knowledge of many aspects of these techniques has simply not been addressed through research. For example, researchers should consider effectiveness of information and education—techniques that address the visitor's decision-making process—as Vander Stoep and Roggenbuck suggest elsewhere in this volume—in designing actions to reduce crowding and congestion. There is an underlying assumption that techniques directly regulating visitor behaviors—such as group size limits, limits on daily entries, and so on—are more effective in...
reducing the congestion problem. The large number of regulations developed by agencies point to this implicit assumption. Yet, the question of efficiency remains, simply because significant fractions of visitors have routinely violated such regulations for varying reasons (Gramann and Vander Stoep 1987, Swearingen and Johnson n.d.).

For example, envision a father and daughter out to enjoy an overnight visit to a backcountry lake about 4 miles from the trailhead. A regulation prohibiting camping within 200 feet of the lakeshore is in effect. On arriving at the lake, the father and daughter are unable to find a suitable flat space for camping more than 200 feet from the lake, but several ideal camping locations are available within the 200-foot setback. They are, therefore, confronted with the choice of hiking in the dark (not the best approach to backcountry travel in an occupied grizzly habitat) and returning to their vehicle or violating the regulation and risk a citation. The couple choose the latter course, but the satisfaction gained is significantly lowered because of the regulation and an expected citation or lecture from a roving ranger. Obviously, the regulation was not effective in securing their compliance or reducing impacts (although they did follow advice for selecting a camping spot as suggested in Soft Paths [Hampton and Cole 1988]).

The example presented is an actual one the senior author experienced in the summer of 1992. Risking a citation and providing a negative model is not the best thing for a professor of Wildland Recreation Management and father of five daughters. Yet, the situation had no easy solution other than to violate a federal government rule and risk investigation by the FBI and prosecution in federal court. In this case, the direct regulation was applied in an area not well suited to provide alternatives to the closures. Trailhead information about the lack of camping sites at the lake would also have helped.

Management actions to address congestion and its consequences are routinely categorized as "direct" or "indirect" (see for example Hendricks et al. 1993). Direct strategies rely on regulation of behavior, while indirect strategies emphasize information and education. Because direct methods regulate or control visitor behavior through relatively intrusive measures, their use has important consequences for perceived freedom—a primary value of leisure activity in dispersed and backcountry settings. Understanding the efficacy of these techniques and the effect of them on visitor experiences seems paramount before their use. Therefore, the purpose of this paper is threefold. First, we want to discuss some conceptual issues associated with the direct-indirect management continuum. These are important if we are to communicate clearly with each other. Second, we will summarize what the research literature does and does not show about these techniques, focusing primarily upon visitor preferences. Our focus is on visitor preferences because it is the visitor that bears the cost of these techniques. And, third, we will suggest a research agenda to attack the gaps in our knowledge.

Direct Management of Visitor Behavior
The Direct-Indirect Management Continuum

Peterson and Lime (1979) prepared perhaps the most definitive discussion of direct and indirect management. They differentiated among three types of techniques: (1) those directed toward influencing visitor decision-making, (2) those aimed at regulating visitor behavior, and (3) techniques applied at the consequences of behavior. These authors include under direct controls such actions as licensing and regulation, with regulation being the direct prescription of what behaviors are permitted or prohibited and licensing the granting of privileges that otherwise would be illegal.

In this paper, direct management techniques are defined as those characterized by legal prescriptions of appropriate and inappropriate behaviors accompanied by formalized sanctions, such as penalties or fines. They are contrasted with indirect techniques that may be described as management actions that change the factors recreationists use to make decisions about appropriate behavior in recreation settings (Peterson and Lime 1979). For example, a direct management action to reduce congestion would be a limit on the number of people to enter a park in a day. An indirect action for the same problem would be to publish information about use levels, assuming that visitors would use this information to choose what day to visit the park. By retaining the locus of control within the visitor, indirect measures provide a context within which the visitor retains the sense of freedom important to recreation experiences.

The literature is a strong advocate for indirect management techniques—those affecting how the visitor makes decisions—over direct techniques, at least in backcountry situations. For example, in the authoritative text *Wilderness Management*, Hendee et al. (1990) propose as one of eleven principles, “Apply only the minimum regulations or tools necessary to achieve wilderness area objectives.” They go on to explain that the “challenge of wilderness management lies in the developing, testing, and implementing of indirect controls that delay imposition of direct controls” (emphasis in original). The preference for indirect techniques over direct has been particularly strong for dispersed and backcountry situations. For example, Clark and Stankey (1979), in their discussion of the Recreation Opportunity Spectrum, show strict regimentation being more acceptable in modern settings than primitive ones. Peterson and Lime (1979) argue “It is usually preferable if benefits can be achieved by indirect means.”

This preference for indirect controls in backcountry has several rationales. First, in designated wilderness settings, the Wilderness Act (U.S. Congress 1964) itself declares the wilderness should be managed for unconfined experiences. A second rationale is that an intrinsic value of recreation is the internal locus of control concerning visitor decisions; i.e., visitors make their minds up about such things as where and when to hike, how many will be in the group, where and how to camp. Regulating these aspects externalizes these decisions and places them in the hands of impersonal and distant agencies.

Lucas (1982) states...
"Recreation and visitor regulations are inherently contradictory. Recreation is a voluntary, pleasurable rewarding activity, based on free choice, while regulations are designed to restrict free choice."

A third rationale is that most studies of visitor attitudes show a clear preference for indirect techniques over direct ones (Lucas 1983). A final rationale for this preference is that indirect measures may be more cost effective than more direct measures accompanied by high enforcement costs.

Bury and Fish (1980), however, report managers feel direct controls are more effective than indirect actions. Indirect measures appear to require more in development and design. Implementation may require naturalists on site to educate visitors. Direct measures use the threat of formal sanctions to secure the appropriate behavior, and may appear less costly initially. However, enforcement requires rangers and a sensitive judicial system. As Cole (1995) notes, managers generally advise to implement indirect approaches first, then moving onto the direct approaches only if the former is found ineffective. He argues this approach requires the assumption that "the effect of the technique on visitor freedom is more important in dealing with a problem such as ecological impact."

There is an implicit assumption in the literature that a question of the appropriateness of direct or indirect management techniques exists only in backcountry situations. The focus of published research on this issue is almost entirely on backcountry. However, we believe significant research questions may remain concerning the efficacy of direct and indirect techniques to alleviate congestion in frontcountry.

Few authors have advocated using direct techniques to manage visitors, though there can be distinct benefits from them. McAvoy and Dustin (1983) point to the sometime unfairness of indirect techniques. They argue there are several rationales to support use of direct techniques. These include failures of indirect approaches, overgrazing the commons, and theoretical approaches to behavior and attitude change stating behavior influences attitudes, not attitudes influence behavior. Dustin and McAvoy (1984) also argue that regulations serve a function similar to a traffic light for controlling the flow of automobiles, i.e., they preserve freedoms many would not otherwise enjoy. The gist of these arguments is that the positive consequences of direct management techniques overcome the negative impacts, particularly to personal freedom.

Despite such discussions, there has been no definitive illumination of the variables that describe a direct-indirect management continuum (McCool and Lime 1989). In fact, despite relatively frequent discussions of direct management in the literature, virtually no definitions of the term exist other than that suggested by Peterson and Lime (1979). The literature seems to contain many apparent synonyms for these techniques. Some authors speak to the use of "heavy or light-handed" techniques, others discuss techniques that are more or less intrusive or subtle, and still others use terms such as regiment, regulate, authoritarian, and coercion. Table 1 shows the dictionary definitions of many terms used in the literature. The table illustrates that these terms have
important variations in meaning, and that it is conceptually possible to implement actions that are direct, yet subtle or indirect and highly visible.

Table 1. Key terms (and their dictionary definitions) used in the literature concerning use of direct techniques to manage recreational use of dispersed and backcountry settings.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>Direct</td>
<td>to manage the affairs of; guide; conduct; regulate; control; to give authoritative instructions to</td>
</tr>
<tr>
<td>Indirect</td>
<td>not straight; deviating; roundabout</td>
</tr>
<tr>
<td>Coerce (coercive)</td>
<td>to restrain or constrain by force, especially by legal authority</td>
</tr>
<tr>
<td>Manipulative</td>
<td>to manage or control artfully or by shrewd use of influence</td>
</tr>
<tr>
<td>Regulate</td>
<td>to control, direct or govern according to a rule, principle or system</td>
</tr>
<tr>
<td>Regiment</td>
<td>to organize and subject to strict discipline and control</td>
</tr>
<tr>
<td>Authoritarian</td>
<td>characterized by unquestioning obedience to authority rather than individual freedom of judgment and action</td>
</tr>
<tr>
<td>Subtle</td>
<td>delicately skillful or clever; deft, ingenious</td>
</tr>
<tr>
<td>Heavy-handed</td>
<td>without a light touch; clumsy; tactless; cruel; oppressive; tyrannical</td>
</tr>
<tr>
<td>Intrude (intrusive)</td>
<td>to force upon others without being asked or welcomed</td>
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Direct management of visitor behavior therefore involves regulation and control of visitor actions. These actions include decisions on where and when to recreate, how to recreate, with whom, what size and type of group, and what specific behaviors (i.e., camp stove use, campsite selection). The regulation of these behaviors may take differing forms, such as use limit policies, formalized rules with fines, and permits.

Licensing, while a form of regulation, is used infrequently, if at all, to manage congestion, although it is used often for regulation of hunting and fishing behavior and commercial outfitting and guiding operations. Licensing has sometimes been proposed as a sort of certification of wilderness users (the Wilderness Education Association for example), but has not gained acceptance by wilderness and backcountry managers.

Barriers are also a form of control on visitor behavior. They include such things as fences, walls, and barricades. Nearly all frontcountry management situations include some type of barrier to confine visitor movements to certain areas. The purposes of barriers are many and include visitor safety, resource protection, vandalism prevention, and maintaining order. Barriers to reduce congestion may be a technique used occasionally in front and backcountry situations.

What We Know About the Efficacy of Direct Management of Visitor Behavior

Our discussion of this objective is based on research published principally in technically refereed journals. While there must be an immense amount of unpublished research and anecdotal experiences, this information has not been archived for efficient retrieval. This situation severely limits our ability to
articulate general principles, concepts, and conclusions about direct management techniques in alleviating congestion. An issue is the question of useful criteria to evaluate the state of knowledge about management techniques. Ideally one would want to know visitor preference and acceptability attitudes, preferences by managers, financial costs of implementation (including enforcement), costs to visitor freedom, and visitor compliance. Cole et al. (1987) reviewed existing studies in their report, classifying direct and indirect techniques within the context of these criteria. Unfortunately, our review of research uncovered no original studies that examined the efficacy of management using more than one of these criteria.

**Research on Specific Techniques**

In this section we summarize the published research results on specific direct management techniques used to alleviate congestion. Our review is designed to be representative of the range of research, not exhaustive, and thus does not include all published studies on this subject. In addition, we have relied most heavily on research appearing in technically refereed journals. Also, somewhat boldly, we identify more general conclusions we believe are justified by research on this question.

**Seasonal or temporal limit on use level**

**Definition:** Use limits are direct restrictions on the number of people that may enter a recreation area.

**Frequency of Use:** Commonly applied in western whitewater river situations and in some terrestrial wilderness.

**Benefits:** Maintains use at a predetermined level, potentially controlling biophysical and social consequences of rapidly growing use levels.

**Costs:** Reduces free access to area; administrative costs of management; use limits tend to generate controversy, particularly in how they are implemented.

**Research Conclusions:** Visitors accept use limit policies if they feel the resource needs the protection afforded by the policy. For example, Stankey (1979) reports that 82 percent of the visitors to a California wilderness supported restrictions on use levels; Fazio and Gilbert (1974) showed a high level of acceptance of use rationing in Rocky Mountain National Park; and McCool et al. (1990) showed that river floaters and hikers in a Bureau of Land Management wilderness in Montana agreed to the necessity of use limits to protect the resource. McCool and Utter (1981) reported general acceptance of use limits among floaters to a whitewater river. Hendee et al. (1968) found opposition to restrictions on visitor numbers in their study of visitors to three Oregon wilderness areas. We exclude here research on specific techniques to allocate or ration use once a limit is implemented. See excellent discussions by McCool and Utter (1981), Stankey and Baden (1977), and Shelby et al. (1982) for research on this question.
**Group size limit**
Definition: Group size limits directly restrict the maximum number of people in one group of recreationists traveling together.
Frequency of Use: Common, used in many backcountry, dispersed recreation and national park areas.
Benefits: Larger group sizes tend to have greater social and biophysical impacts; group size limits reduces these impacts.
Costs: Reduces access to area for groups wanting to travel together; limit must be feasible for outfitters when present; administrative costs.
Research Conclusions: Visitors tend to accept implementation of a limit on group size, particularly if all types of groups are limited to the same size. Roggenbuck and Schreyer (1977) report that 84 percent of the respondents in their study of river users supported the concept of a limit on group size. One concern is the size of outfitted or guided groups. These must be large enough to make it financially feasible.

**Campsite assignment**
Definition: Campsite assignment involves allocation of individual campsites to specific groups before the group's entry into a recreation area, much like a reserved seat on a passenger aircraft. Campsite assignment programs are sometimes called "fixed itinerary" management.
Frequency of Use: Fairly common in western whitewater river recreation (e.g., Yampa and Green rivers, Dinosaur National Monument), and in some national park backcountry (e.g., Big Bend, Glacier and Yellowstone national parks).
Benefits: Optimize use of backcountry campsites with limited area/capacity: known amount of use at each site; reduction of interparty competition for limited number of campsites.
Costs: Loss of solitude at campsite areas, significant reduction in visitor freedom of choice, assumes all visitors will comply, has limited flexibility for accidental violations, significant administrative costs.
Research Conclusions: Attitudes of visitors toward campsite assignments are mostly negative (Anderson and Manfredo 1986, Lucas 1985). Roggenbuck and Schreyer (1977) report most respondents in their study of river users supported campsite assignments. This was in a situation where campsite assignments were used. The research suggests visitors are willing to accept campsite assignments or fixed itineraries if this is the only way they would have access to the area.

**Area closures**
Definition: This action includes prohibiting all or some types of recreational use of particular areas. Such actions may involve prohibiting camping in a designated area, allowing camping only at specific sites, closing the area to all recreational use, requiring a permit before entry to the area, and prohibiting camping within certain distances of surface water.
Frequency of Use: Common at historic sites, museums, and other high use locations (such as near visitor centers at high-altitude locations). Also found in some national park units in such places as meadows.

Direct Management of Visitor Behavior 73
Benefits: If closures are obeyed, removes all direct human influence and impact at the site.
Costs: Restricts visitor freedom to walk, camp or recreate in the area in the way sought. Requires signing and enforcement.
Research Conclusions: Research shows visitors will often show support for restrictions, particularly if they understand the rationale for them or if the benefit is clear (Frost and McCool 1988). Presence of management personnel is more effective than signing in achieving compliance to a "Keep on the Trail" requirement in a national park (Swearingen and Johnson 1988, 1995). Anderson and Manfredo (1986) report that opposition to camping restrictions was greatest for prohibitions on camping within 100 feet of water surfaces. Respondents in this study were also opposed to permits for specific camping sites but did support limiting the number of designated sites. Cole and Ranz (1983) showed that about 80 percent of the groups in their study obeyed a backcountry campsite closure.

Campfire restrictions
Definition: Campfire restrictions are not directed at reducing congestion as much as they are oriented toward reducing the visible and biological effects of use. Campfire restrictions usually come in two forms: (1) campfires restricted to designated fire rings or (2) complete prohibition of campfires. In some cases, the use of "green" material or collection of firewood is also prohibited.
Frequency of Use: Frequent in frontcountry, less frequent in backcountry.
Occasionally, campfire prohibitions are implemented in response to drought conditions or fire danger.
Benefits: Significant reduction in potential wildfires occurring from campfires, reduction in fuelwood use, reduction of ecological impacts due to wood gathering in large areas around the campsite (Cole and Dalle-Molle 1982), reduction in soil sterilization within the fire pit (Fenn et al. 1976), and reduction in impacts associated with gatherings around the fire.
Costs: Enforcement and loss of the value associated with campfires used for aesthetic reasons.
Research Results: Anderson and Manfredo's (1986) study of wilderness users report significant opposition, as does Lucas (1980) in his study of wilderness visitors in eight wilderness areas in Montana and Idaho. However, Bultena et al. (1981) report significant support for this technique among backcountry campers in Mt. McKinley (Denali) National Park.

Group type restrictions
Definition: Prohibition on entry to an area based on some characteristic of the group. Group type restrictions are similar to area closures in practice: the area is open to recreation use except to those possessing the undesired characteristic.
Frequency of Use: Nearly all national park and other recreation areas employ restrictions on some visitor group types. Most frequent are prohibitions on use of motorized or mechanized means of conveyances—boats, vehicles,
and bicycles primarily. Some backcountry areas prohibit users on horse and bicycle.

**Benefits:** Significant reductions in biophysical impacts and visitor conflicts; increased visitor safety and satisfaction.

**Costs:** Reduction in visitor freedom and accessibility to some areas; enforcement of restrictions; signing and publication of restrictions.

**Research Conclusions:** Group type restrictions are generally controversial, particularly in backcountry area previously open to all visitor types. Visitor attitudes vary significantly on this issue. McCool et al. (1990) report three visitor groups in a Montana wilderness viewed restrictions on visitor group types acceptable—for the other groups, but not themselves. Anderson and Manfredo (1986) reported significant support for prohibitions of motorized watercraft and vehicles.

**Length of stay limits**

- **Definition:** A rule limiting the amount of time a group may stay in a recreation area. The extreme case is limiting use to daytime only.
- **Frequency of Use:** Many backcountry areas have implemented these limits, and they are commonly found in frontcountry campgrounds.
- **Benefits:** Increased accessibility to the area for more visitors.
- **Costs:** Reduces opportunity for visitors to enjoy extensive visits to the area; enforcement and administrative costs.
- **Research Conclusions:** Research on this regulation has been limited.

**Technology requirements**

- **Definition:** Technology requirements include requirements for cooking stoves (versus using wood fires), certain types of safety equipment, portable toilets, etc. As with campfire restrictions, these regulations deal more with the effects of use than congestion itself.
- **Frequency of Use:** Fairly frequent, particularly on whitewater rivers and many terrestrial wilderness settings.
- **Benefits:** Reduces biophysical impacts.
- **Costs:** Administration and enforcement of requirement; education concerning proper use of technology.
- **Research Conclusions:** Visitors generally accept technology requirements if they understand rationale and role of requirement in preventing resource impacts.

**Trip scheduling**

- **Definition:** Trip scheduling involves establishing the location and timing of individual group use of a recreation area. Examples include timing of raft launches on rivers, group naturalist tours of both backcountry and frontcountry resources, and designated times for viewing historic sites, interpretive films, and displays.
- **Frequency of Use:** Common in frontcountry situations involving historic resources and visitor centers. Used occasionally on whitewater rivers, especially in conjunction with campsite assignments.
Benefits: Reduces congestion; provides opportunities for solitude (in river situations); increased opportunities for interpretation; less competition for limited space in some situations.

Costs: Elimination of visitor freedom to view and appreciate resource whenever wanted; costs to administer schedule and permits; personnel costs for tours.

Research Conclusions: Little research available for frontcountry, however, scheduling of films and tours of historic resources is a commonly used technique in a variety of private and public situations. Anderson and Manfredo (1986) found only modest support for this technique among wilderness users. Somewhat higher support was found for advance reservations among Denali National Park hikers (Bultena et al. 1981). Utter et al. (1981) showed preferences for advance reservations were higher among visitors using commercial outfitters than those floating the river on their own.

Barriers

Definition: A barrier is a deliberately established obstacle to visitor movement.

Frequency of Use: Common in frontcountry; fairly common in backcountry.

Benefits: Reduction of visitor impacts; reduction of vandalism; efficient movement of people through a site.

Costs: Reduction of visitor freedom to walk/drive wherever they want; construction and maintenance costs; enforcement; visual intrusion into experience.

Research Conclusions: Very little research has been published on barriers as a congestion management tool. Tarbot et al. (1977) found support for low standard trails and leaving fallen trees across trails; Stankey (1980) showed half the respondents favored reducing trails and blocking access roads.

General Research Findings

In this section, we present our interpretation of what this research says in a more general way about visitor reactions to direct management. These generalized findings are stated as hypotheses and represent our understanding of the accumulation of research, not necessarily specific study findings.

1. Visitor support for direct management is highest when the rationale is understood and the benefits of such techniques can be easily visualized.

2. Visitor support for direct management is highest in national park settings, least in backcountry and designated wilderness.

3. Visitor support is highest in settings with a tradition of direct management, lowest in settings that are proposing increased direct management.

4. Visitor support for direct management is highest for techniques with which they are familiar, least for new techniques.

5. While visitors accept many techniques, they would prefer to have less direct management.
6. Preferences and acceptability of direct management are influenced by visitor motives for visiting the setting.

7. Visitors prefer controls administered external to a backcountry setting to those administered internally.

What We Do Not Know about the Efficacy of Direct Management Techniques

Our level of knowledge about what we do not know far exceeds our knowledge about what we do know. And much of what we do not know is important in assisting managers in making informed decisions about not only alternative direct management techniques but also alternatives to direct management.

Primary among these unresolved questions is the implied direct-indirect continuum. As we noted earlier, no evidence from studies of visitors exists to support the notion of a continuum. The notion of a continuum is an important research and management issue, if only because we assume it exists. We also believe it is an important issue because how appropriate behavior is defined and enforced is a major component of the setting and directly affects visitor satisfaction and willingness to comply with the recommended appropriate behavior.

The literature we reviewed indicates a concern about whether a technique directly controls one's behavior or manipulates factors which visitors use to make decisions about their behavior. In addition, we note another concern that deals with how such techniques are implemented. For example, a regulation prohibiting off-trail travel may be implemented through an informational sign or through the presence of an officer enforcing the ban with a ticket and fine. Each technique has significantly different impacts on visitor behavior (Swearingen and Johnson 1988) and consequences to visitor satisfaction. Thus, a technique may be a direct one, but enforced subtly. For example, Swearingen and Johnson (1995) report a regulation prohibiting off-trail travel—what most of us would agree to be a direct technique—was enforced simply by the presence of uniformed employees. Compliance with the prohibition increased, without the employees taking enforcement action.

Thus, there are at least two dimensions to the overall issue as shown in figure 1. Our research question is, therefore, the extent to which visitors perceive a two dimensional space as we hypothesize. If such a space exists, then, we believe, it is important for park managers to proceed with further research. If no such space exists, then the only question with which managers are confronted concerns the administrative costs and benefits of an individual technique and some of the indirect consequences of its implementation. There would be no need to discuss direct versus indirect techniques.

We believe strong anecdotal evidence exists for such a space. We also believe, given the previous statement, that direct management techniques should not be viewed in isolation of other, indirect actions. Gramann and Vander Stoep (1987) note that violations of normative standards of appropriate behavior...
result from several reasons. For some of these reasons indirect techniques may be effective solutions, for others direct approaches coupled with enforcement may be the only realistic action. Thus, we agree with McAvoy and Dustin (1983) that integrative approaches, using a combination of indirect and direct techniques are appropriate.

Therefore, we suggest the following issues be investigated.

1. **What are the social and administrative costs of direct management techniques?**

We have begun to accumulate a considerable knowledge about visitor preferences and attitudes toward varying management techniques. However, we found little research that systematically explored how much it actually cost to implement a technique (in terms of staff and financial resources) or the social costs in terms of loss of perceived freedom. Exploring this question to develop greater understanding of the benefits and costs of different techniques would be useful. Until the relative costs and benefits are identified, the efficiency of direct or indirect techniques can only be hypothesized.

2. **To what extent are visitors willing to tradeoff decreased freedom under a direct management action for increased access to a site under indirect management?**

One can argue that the preference among managers and researchers for indirect techniques is that it preserves a certain level of freedom of choice. However, visitors may be willing to give up some freedom of choice if they can gain increased access or are guaranteed access to a recreation site. The loss of freedom of choice is one that has only been argued, not necessarily one that empirical research can support. We suspect visitors would be willing to give up...
freedom of access under certain conditions, such as the ability to view a spectacular resource or participate in a certain activity with few others present.

At least two studies provide evidence that visitors accept or respond positively to direct techniques. Frost and McCool (1988) reported that visitors in Glacier National Park felt regulations on visitor behavior to reduce impacts to bald eagles enhanced their experience. Swearingen and Johnson (1995) found that visitors responded positively to the presence of uniformed rangers when visitors felt a need for information, safety, resource protection, and law enforcement. These two studies suggest the direct-indirect continuum may be more complicated than a single dimension.

We suggest researchers look into how visitors evaluate the tradeoffs between direct and indirect techniques and their consequences for freedom of choice and access to the area. A closely related question concerns the conditions influencing preferences for techniques: what variables (e.g., social-demographic characteristics, previous experience, expected benefits) influence these preferences? Knowing these variables, can managers exploit these relationships?

3. How do manager attitudes toward direct and indirect techniques compare to visitor attitudes?

Research comparing manager attitudes toward a variety of setting attributes with visitor attitudes in the 1970s and 1960s showed significant differences in preferences. We might find that pattern for attitudes toward direct and indirect techniques. If so, we would be able to challenge our assumptions about the social costs and benefits of specific management techniques better.

4. How does the desirability of a direct management technique differ from its acceptability?

We suggest a significant difference exists between the desirability of a management technique and its acceptability. We feel while visitors may be willing to accept certain approaches to managing recreation settings and regulating visitor behavior, they may prefer (or desire) other approaches. In some situations, little difference may exist between acceptability and desirability. Anecdotal evidence exists that visitors prefer indirect techniques over direct techniques. By investigating this question, we would gain knowledge about such issues as the relative social cost of one technique versus another, the ability to substitute, for example, a direct technique for an indirect one, or the width of the range of acceptability.

5. To what extent does implementation of direct management displace visitors to other, less desirable recreation sites?

One of the interesting issues in management of recreation settings is the effect of management actions on displacement of visitors. There is some evidence (Gleason 1980) that this process exists, but more systematic research would be helpful. For example, we could answer such questions as: what types of direct management result in displacement? Where are people displaced to? To what extent are these substituted settings desirable or acceptable ones?
6. How do recreation settings and management philosophies influence visitor perceptions of appropriate management techniques?

One of our summary conclusions was that visitors in national park settings are willing to accept more regulation than those in dispersed wilderness settings. But are expectations for formalized means of social control higher in national park units than in other settings? If so, why? What benefits do visitors perceive from regulation in these settings that they might not see in other settings? Do visitors in frontcountry have higher expectations for social control than those in backcountry settings?

7. How do visitor motivations influence perceptions of the appropriate location of management options within the two dimensional space of the diagram in figure 1?

Visitors bring with them a variety of motivations when they enter a recreation area. An important question deals with the association of these motivations with specific management techniques. For example, are visitors motivated by escape less likely to prefer direct management techniques than those whose primary motivation is the desire for affiliation? Understanding what these associations are will help us better predict the consequences to recreational experiences of direct management actions.

8. Which technique along the continuum of possible management solutions provides the most equitable outcome in a given situation?

Direct management actions will affect diverse individuals and groups differently. For example, Stankey and Baden (1977) note varying effects of rationing techniques. It would be desirable to develop greater understanding of the "fairness" of different techniques and which groups various techniques favor or discriminate against. This would help managers develop a regime that would avoid an unconscious but nevertheless systematic bias against one type of visitor.

9. How are visitor perceptions of acceptability related to the urban-rural context of national park units?

Like many other regions, national park units in the Midwest Field Area are located in a variety of biosocial contexts, in particular the urban and rural settings. The social appropriateness of differing techniques is influenced by the location of these settings. For example, a scheduling system to reduce congestion along with the associated administrative apparatus (tickets, etc.) seems more appropriate in a high use urban setting than in a rural backcountry area. This question appears to be a significant one given the diversity of units in the Midwest Field Area and should be addressed.

Conclusion

National park managers have a wide range of tools available to manage congestion. And, there is undoubtedly a great deal of experience in their
application. Unfortunately, our knowledge of the efficacy of these techniques is still largely anecdotal. This experience is invaluable and should be documented, synthesized, and archived. We do have considerable knowledge of the social acceptability of congestion management techniques in backcountry settings, but information about other criteria, such as administrative cost, has not been archived. Again, we have a good idea of visitor preferences in backcountry areas, but little systematized knowledge about preferences in frontcountry and more urban situations.

The underlying implicit continuum of direct-indirect management techniques have never really been tested. While it is frequently assumed that visitors prefer indirect approaches, there may be a large class of settings and situations where visitors prefer the more direct and intrusive ones, particularly in places such as high demand historical sites. This is not simply an academic question. Management styles not only serve to protect the resource, but they may also result in important impacts to visitor experiences. Therefore, we recommend the NPS embark on an exploration of this question.

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82


Is Your Park Being "Loved to Death?": Using Communications and Other Indirect Techniques to Battle the Park “Love Bug”

Gail A. Vander Stoep and Joseph W. Roggenbuck

Setting the Stage
Social Science: Not a Bottle of Snake Oil

Social science is sometimes misunderstood or viewed with skepticism. Such uncertainty is usually rooted in its differences from natural sciences (often labeled “hard sciences”) and some people’s perceptions that scientific results are always found in test tubes where variables are carefully controlled and manipulated. While research approaches vary widely depending on topic, subjects, and objectives or hypotheses, lack of test tubes does not infer snake oil science. Accordingly, social science is not snake oil. In the context of park management, it is not just a disguised bottle of water, hiding behind artificial colors, fragrances, and fancy labels, touted by a traveling Snake Oil Science Salesperson as a “solution to all your visitor and resource management problems.”

Social science can help identify the


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conditions and variables that influence behavior as well as critical factors involved in personal decision making processes often linked to behavior.

People are barraged constantly by a stream of sensory input, all of which cannot be processed simultaneously, consciously or subconsciously. Because humans screen sensory input (to prevent stimulus overload and confusion), they often rely on previous experience, previous ways of categorizing input and making sense of the world, and previous ways of behaving in order to take action in a new situation. Repeated use of these mental constructs not only helps people function efficiently, but sets up social rules of behavior which can be interpreted easily and quickly by others. It also reinforces patterned behaviors, especially repetitive behaviors which have not been strongly challenged by unusual stimuli or strong, logical argument. This in turn creates clusters of behavioral tendencies. Social science helps to identify these tendencies.

Social Science: Not a Magic Potion Either

So then, is social science a magic pill? By using social science, can strategies be devised to solve all those nagging people problems at parks by next week? Can resource managers order a bottle of social science-based management pills to heal their overimpacted parks? Well, no. While social science can help us identify behavioral tendencies within certain contexts, it does not provide magic potions for precisely explaining or predicting how people behave in all situations or for solving problems created by human behavior. After all, humans are not electronic robots with clearly programmed circuitry. If social science were a magic potion, the world would have no poverty, no juvenile delinquency, no crime, no war, no alcohol or drug abuse. The list of solved social ills would be extensive if all it took was one quick study to find the single solution to a specific people problem.

Just as in the broader societal context, social science cannot completely explain or predict human behavior in outdoor recreation and natural resource sites, nor can it give us ironclad solutions for our management problems. First, the management problems (and associated issues) are complex. Often they involve varying resources and a multitude of management objectives and user goals, frequently contradictory to one another. The classic example is the dual-pronged National Park Service (NPS) mission of protecting natural and cultural resources while providing for their enjoyment by people in perpetuity. Second, humans are incredibly complex, with diverse values and cultural, social, economic, and moral perspectives. Additionally, multiple factors impact on and influence human decisions and behavior. Some of the variables and input, from a continual barrage of sensory stimuli, actually are screened out. Additionally, the multitude of variables influencing people’s behavior shift in priority depending on mood, context, social group, recent occurrences, and other factors. All the factors identified above interact with each other, are open for personal interpretation based on an individual’s related knowledge and prior experience, and are influenced by social pressures emanating from others. Consequently, the complexity of human behavior increases and the possibility of finding single, simple solutions applicable in all situations and for all people decreases.
Several other variables, more inherent to Western culture in general than specific to NPS or other resource agency management issues, but which do have impact, further complicate efforts to solve resource management problems. Some of these contextual constraints are:

1. The Western habit of perceptually boxing the world into little compartments, each separate from the others, with the assumption that humans can fix a problem inside one box without affecting what happens in the other boxes.

2. The United States political structure (and associated mind set) that encourages dealing with problems in the short term rather than the long term . . . because they are easier to view that way, because the political power group (along with its associated values and priorities) may change in a couple of years, and the funding support for a project or program may no longer exist in a few years.

3. An underlying assumption by many that any problem that presents itself can be solved by implementing a short-term, quick-fix solution, often relying on technology.

All of this holds just as true for NPS and other outdoor recreation resource and visitor management issues as it does for larger societal problems. People's behavior is complex wherever they are. The same people who live in towns, cities, and rural areas are those who visit national parks and other resource-based recreation sites. Just because people happen to be on vacation, are recreating or otherwise out to have a good time, their behavior does not change completely. Some variables influencing their behavior may change, and the strength of influence of these variables on decisions and behavior may shift (i.e., some decision-making factors may become more important relative to others when people are recreating than when they are at home or work), but recreators still carry with them a set of personal beliefs, values, knowledge, and experiences.

Social Science Can Help Identify Appropriate, Effective Management Strategies

So why is social science needed to identify behavioral tendencies? Why can't managers rely on gut feelings if tendencies and social rules are applicable to groups of people, not just to individuals? Well, perhaps that could be possible . . . IF all people were socially, culturally, religiously, politically the same, and IF they all had the same sets of experiences and comparable education. This, of course, is not reality. Although hunches may be correct sometimes, a danger exists because hunches evolve from personal experiences, value structures, and views of the world. Social science allows us to step back from personal assumptions and world views to observe how other people act, react, and interact with each other and their environment. As visitors to national parks become increasingly diverse and numerous, traditional managerial hunches are less likely to be correct, and the potential for conflict between different people more likely to occur. Social science cannot give us all the answers. However, it
can provide invaluable assessment and decision-making tools for the management toolbox... if it is implemented and applied appropriately, and if it is integrated with other tools available to a park manager. For example, Chavez (1996) describes a "package" of resource management tools used to manage mountain biking in national forests. The package includes indirect techniques (education/information), direct techniques (use limits, law enforcement), design elements (hardening of trails), and partnerships and personal interaction with bikers and organized biker groups.

What Management Issues Do We Want to Address?

Natural and cultural resources management issues related to congestion, overcrowding, and inappropriate visitor behavior certainly are not new. Over the years there has been debate about whether congestion and overcrowdedness are absolute or perceptual. The consensus seems to be that a combination of the two is involved: resource impacts may result simply from presence and movement of too many visitors (related to biological or physical carrying capacity) AND people may perceive congested or crowded conditions when the number of people encountered is more than expected or others interfere with their personal experience (related to social or psychological carrying capacity). This duplicity further complicates efforts to find precise solutions to the problems. What one visitor perceives as a crowding problem may not be considered a problem by others; in fact, some may prefer it. Additionally, perceptual assessment of resource problems associated with too much use may be quite different between managers and park users (Marion and Lime 1986; Shelby et al. 1988 in Vande Kamp et al. 1994). Often this is because their goals and experience with the resource are different.

Nevertheless, two general categories of impacts or problems can be associated with overcrowding and congestion. The first is the impact of people on the resources—natural, cultural, and historical as well as the built environment that provides support services. The second is the impact of one group of people on others. Additionally, a variety of visitor behaviors could be considered inappropriate for general or specific recreation sites, disruptive to other visitors, and depreciative or in some way damaging to the resource. In fact, a recent survey of NPS administrative units (Johnson et al. 1994) found that damage caused by park visitors breaking park rules or guidelines would cost approximately $80,000,000 to repair and cost an additional $18,000,000 for general cleanup (e.g., litter) and minor repairs across the system. The following lists identify some impacts related to congestion, overcrowding, and visitor behavior, including depreciative and noncompliant behavior.

Impacts of People on Resources
- Inadvertent or unintentional damage to the resources (result of too many people using a given resource, over too short a time to allow recovery or regeneration, which can cause damage to soils, vegetation, wildlife, cultural resources, physical structures, etc.).
• Careless use of resources resulting in damage (e.g., litter; cigarette butts or unattended camp or cooking fires which could cause uncontrolled fires; pounding nails in trees to hang lanterns).
• Stress on infrastructure, often by outstripping capacity for which a system or structure was originally designed (water supply and waste treatment systems; roads, bridges, buildings and visitor centers; electrical systems, etc.).
• Technological advances and changes in user equipment which often do not match original site design or intended uses (e.g., RVs which require larger, straighter roads with less grade; stronger bridges; wider turning radiiuses; larger campsites, and water, sewer and electrical hookups; development of new recreational equipment such as ATVs/ORVs, snowmobiles and jet skis which can cover more territory and impact some resources quicker than other equipment).
• Intentional behaviors, often not perceived as damaging behaviors by those engaged but which do damage resources (e.g., carving on trees, bridges, railings; feeding wildlife; shortcutting of trails; wandering off designated trails to reach spectacular views or interesting objects).

Impacts of People on Other People
• Activity conflicts between different user groups (interference with or prevention of some activities or experience types, such as conflicts between snowmobilers and cross country skiers, hikers and horseback riders, fly fishing anglers and personal watercraft users).
• Blocking of visual access (e.g., crowds of people or cars preventing views of wildlife, panoramas, or other resources).
• Transportation slowdowns or gridlocks (resulting in more time needed to visit a site or a reduction in the amount and type of activities possible within the time available; increased frustration).
• Spatial or temporal displacement of some visitors who choose to go to different sites or visit at a different time because they dislike either the crowds or the behavior of some visitor groups.
• Negative impacts on visitors' experience quality (e.g., noise, pets, large groups disturbing solitude experiences).
• Dissatisfaction with a visit or experience because the reality did not match expectations (cognitive dissonance), often a result of glitzy, romantic tourism promotion that frequently shows sites with few visitors.
• Increased time for maintenance needs (e.g., lines at gas pumps, stores, entrance stations, campgrounds, restrooms, restaurants).
• Visitors possibly turned away at campgrounds, hotels or lodges, entrance gates, etc.

Communications and Other Indirect Techniques
• Increased criminal activity (potential thieves with easier access to parks are realizing that vacationers are easy targets because they tend to let down their guard when traveling and recreating. Also, getting lost in the crowds is easy, making it possible to hide illegal activities).

• Increased agitation of visitors due to all of the above, which potentially can increase their likelihood to behave in ways negatively impacting resources or other visitors.

Tackling Management Problems

Park managers have two general approaches for dealing with visitor-induced damage to resources (Harrison 1982; Manning 1986; McAvoy 1985) and user conflict management issues: direct and indirect. Direct approaches, which overtly regulate visitor behavior through techniques such as regulation enforcement (fines, imprisonment, and/or other sanctions), activity restrictions and prohibitions, use rationing, and surveillance are the topic of another paper in this series. Indirect approaches rely on two basic strategies to guide visitors' behavior in ways protective of natural and cultural resources: (1) facility design and maintenance, and (2) various communications strategies that promote education and personal involvement. Because the perception of freely-chosen behavior is an important dimension of outdoor recreation experiences (Christensen and Davis 1984; Iso-Ahola 1980; Lucas 1981), indirect approaches have public relations and other advantages over direct approaches in such settings. These advantages will be discussed in more detail later. One strategy, which has elements for both direct and indirect influence, is the presence of uniformed rangers. While ranger presence may suggest a threat of sanctions to some visitors, it also can be one channel through which information and education are disseminated, so will be included in this discussion.

Indirect Strategies: Focus on Communications

The focus of this paper is on using communications (variably called information, education, interpretation, and persuasion) to reduce deprecative behavior, distribute use, reduce conflicts, and encourage resource protective behavior. However, not all the problems identified above can be corrected or even addressed by communication and information dissemination. Design, rehabilitation, and retrofitting of facilities, law enforcement and sanctions as well as communication and information management strategies should be selected based on their effectiveness and appropriateness for achieving specific objectives. These strategies can, and often should, be used in combination for several reasons: visitors are diverse, so their perceptions of various strategies and messages will be different; settings are diverse; visitor groups are different in size and other characteristics; and visitation motives are diverse. It is the managers' challenge to determine and apply the most appropriate combinations of indirect and direct approaches to achieve management objectives at their parks, based on both specific park and visitor characteristics as well as political, economic, and other contextual factors.
Though combinations of strategies should be used to address many management problems (Irwin 1985; Vande Kamp et al. 1994; Wang et al. 1996; Chavez 1996), there seems to be increasing support for using communications as a major component of future recreation resource management strategies. Several publications during the past decade (such as the President's Commission on Americans Outdoors [PCAO] Literature Review and the 1988 Outdoor Recreation Benchmark Symposium Proceedings) allude to a managerial movement to broader use of communication as a resource management tool. As an example, the introductory paragraph to the "Use of Information and Education in Recreation Management" section of the PCAO Literature Review states:

"Considerable research has demonstrated that information-education programs are seen as acceptable components of management both by users and managers, and that they can be effective in solving certain management problems. Increasing numbers of managers support this approach, and recreationists frequently ask for more information... Recreation managers are increasingly interested in the use of information and education as a management tool because of its potential ability to increase the quality of recreation experiences, reduce social conflicts and resource impacts, gain support for management practices, and reduce management costs during times of budgetary constraints and personnel changes" (Roggenbuck and Ham 1986).

During the fourth International Outdoor Recreation and Tourism Trends symposium in 1995, a 1994 assessment on current issues in wilderness management was presented and compared with results of a similar study conducted in 1983 (Barnes and Krumpe 1995). While "educating nontraditional publics on wilderness values" was ranked fourth in each study, it received stronger support in 1994. Additionally, several other education-related issues were ranked considerably higher than in 1983 ("Leave No Trace" training ranked 6th vs. 16th; miscellaneous education ranked 18th vs. 30th). Several other issues identified in 1994 were not even mentioned in 1983, including wilderness education in schools, information sharing all the way down the line and between agencies, increased use of partnerships, reaching users who do not seek out information, public education in ecology and natural resources. A few issues identified each year, ranked fairly low both years but more highly in 1983, included public participation (ranked 35th vs. 21st), educating outfitters and other authorized users to ethics and minimum impact use (ranked 56th vs. 47th), and funding for wilderness education (ranked 69th vs. 55th).

Barnes and Krumpe (1995) state that the "top two issues in 1994 concerned with education... both show significant increases in their percentage of the maximum possible scores over 1983." Education, of nontraditional (off-site or nonrecreational) users as well as traditional users (on-site recreationists), was an important component of wilderness stewardship in 1983. It is even more so in 1994. This trend is underscored by the emergence of two issues in 1994 that did not surface in 1983: wilderness education in schools (K-12) and lack of biocentric philosophies in the public.
This thrust in use of information and education, for purposes of education, stewardship, and resource management, also is supported by changes in legislation (such as amendments to the Archeological Resources Protection Act [ARPA]) which include education as a mandate, and by recent symposia and workshops (such as the workshop on Solving Management Problems through Interpretation, sponsored by the Federal Interagency Council of the National Association for Interpretation) which have focused on the use of communication and other indirect techniques to tackle park management problems.

Two major questions now become:

1. How can communication strategies be shown to be truly effective at addressing management problems? (This indicates a need for monitoring, evaluation, and research.)
2. How can these strategies be most effectively implemented and integrated with other management strategies?

Before embarking on an unplanned research agenda, it is important first to identify what is known from previous research. A summary is presented below.

So What Is It That We DO Know? An Approach to the Issue

Diverse Ways of Knowing

There are many ways of knowing. It is beyond the scope of this paper to explore the variety, but for our purposes it is important to recognize that what we know about how information/education/interpretation/persuasion can be used as a management tool to deal with overcrowding, congestion, and other people problems comes from several sources. These sources include gut-level hunches (intuition), informal observational assessment, reliance on theories and beliefs generalized and applied to recreation management settings, anecdotal data and case studies, and correlational and experimental research studies. Some perceive that bias or other sources of error exist in all ways of knowing except experimental, lab research. Such errors do exist, but they exist also in experimental research. Social science research, which utilizes both experimental and a variety of other research techniques, is not immune to bias. This does not invalidate the methods, but it does suggest that the limitations of each method and its respective results (in interpretation, context, and all other site- and case-specific variables) are recognized and that patterns in effectiveness of various indirect management techniques are identified.

What Do We Mean by Effective Indirect Approaches?

In evaluating the effectiveness of anything, there are always multiple ways of measuring success. Therefore, it is critical that measurable objectives be set specifically for the evaluation of any management strategy, particularly when multiple benefits of various strategies are possible. Effectiveness at controlling negative behaviors should be weighed with other benefits and pitfalls of...
alternative strategies. For example, even if a communication technique by itself may not be quite as effective at deterring specific behaviors as another technique (such as assessment of fines, threatened sanctions, or other legal actions), other benefits and negative impacts of each technique should be recognized and considered for their roles, impacts, and importance in the broader management picture, particularly over the long term. Some peripheral benefits (perhaps even primary goals by themselves) of effective communication and other indirect strategies can include improved relations with specific stakeholder groups (e.g., recreation users, nearby residents, conflicting nonrecreational resource users), greater sense of ownership of and support for the resources, increased personal involvement in caring for the resource (e.g., participation in site cleanups, assistance with trail building, cooperation and participation in historical reenactments), improved self- and peer-policing (and possibly reporting of inappropriate behaviors), and increased trust in resource managers. This list is by no means exhaustive, but it indicates peripheral benefits of communication that, in the long run, may be even more important than short-term changes in user behaviors that are less damaging to the resource or that address other crowding-related management issues. McAvoy and Dustin (1983) assert that visitors often prefer indirect techniques because they are less threatening to personal sense of freedom, especially while recreating, than direct techniques. It should be noted, however, that even with these potential benefits, indirect approaches by themselves may not be effective in reducing or eliminating depreciative or other noncompliant behavior in all visitors or in all settings or contexts (Vande Kamp et al. 1994).

First We Have to Know WHY Resource Damage Occurs

Many crowding- and behavior-related management problems were listed in the previous section. Also stated was that a primary objective of this paper is to discuss a variety of indirect management techniques that can be used to reduce depreciative behavior. This term has been used in several ways, sometimes as discreet from vandalism, sometimes as a broader concept which includes vandalism. In any case, depreciative behaviors are those that cause damage to natural, cultural, historical or developed resources. Sharpe et al. (1994) define vandalism as “any act that willfully defaces or destroys some part of an outdoor recreation area and results in increasing costs to the manager or lessening the appeal of the area to the visitor.” This definition suggests the role of willful motivation in destructive acts. However, regardless of whether a damaging act is willful or unintentional, an important concept is that all such acts occur for some reason. Motivations vary between people, resource settings, contexts, social groups, and times. These diverse motivations have been categorized various ways, but each classification system includes some variation of the following:

- Normal, appropriate use, but there is just so much of it and so many people involved that damage occurs.
- Conscious, intentional acts engaged in for reasons other than for damaging resources (e.g., for fun or thrills, case of achieving some other goal, peer
pressure, releasor cues suggesting appropriateness), but which create
damage without the actors realizing it.

- Intentional acts known to cause damage, but the actors do not care for some
reason, or do not attribute the blame or responsibility to themselves (e.g.,
denial of personal responsibility or projecting blame on others or external
conditions; belief in individual rights or frontier attitudes which supersede
social or environmental rights; conscious choices to act inappropriately
because the appropriate behavior may cause additional effort, be
inconvenient, or dangerous in the present situation).

- Intentional, illegal acts (e.g., theft of artifacts, plant materials; poaching;
intentional vandalism; violent protest behaviors; theft from other users;
assault).

Therefore, it is critical—if management strategies are to have a good chance
of succeeding—that the motives for depreciative behavior and reasons for conflict
are identified and understood in order to select strategies that will address the
reason for the inappropriate behavior, not just the symptom. After all, bandaids
do not last long and do not heal the source of the injury or infection.

Motivations as Just One Part of Complex Human Behavior

Several models and theories have been proposed to help explain the complexity
of human behavior. Most incorporate some relationship between attitudes,
beliefs, values, and behavior. Most include:

- Precursor variables (conditions within an individual such as attitudes,
beliefs, values, awareness or knowledge of an area's resources and/or its
regulations, reasons for the visit).

- Context variables (social group and associated social norms, group size,
demographics, setting, presence of authority figures, familiarity with area
and/or managing agency, etc.); and

- A variety of external factors which can come into play at varying times
before a behavior actually occurs (presence of attractive alternatives [such
as shortcutting across an area instead of following a trail or walkway to get
to the intended location], presence or absence of facilitative amenities and
facilities [such as availability of empty trash cans], attitudes expressed by
authority figures [e.g., rangers] toward visitors, or opportunities to shift
blame to someone or something else).

Some of these models are presented in the figures. Viewing these models, it
becomes apparent why it is difficult to identify or develop a single strategy to
reduce destructive or damaging behavior because so many variables influence a
person's decision-making process which leads to behavior. It is almost
impossible for a resource manager to control ALL of the relevant variables.
Complicating the issue, as suggested by Vande Kamp et al. (1994), may be that
park and other resource areas may assume or be perceived to have
characteristics of common resources, and thus be subject to the commons
dilemma—that visitors do not fully understand short- and long-term
consequences of their actions and they will often act in ways beneficial to themselves rather than considering impacts to the resource or others. However, this does NOT mean that effective management strategies cannot be developed by identifying some tendencies and incorporating the most important variables that ARE within a manager's control. Some models are general in nature; others are applied more specifically to resource management; still others go only as far as identifying relationships between communication (or persuasion) and attitudes, but do not include resultant behaviors. Summaries of some models follow.

**General Decision Making Influenced by Many Factors**

Bar-tal's (1976) decision-making model identifies several factors—personal characteristics, situational variables, cultural variables, and characteristics of a person in need—which are considered in a mental cost/reward calculation and linked to a person's attribution of responsibility for certain decisions and behaviors. Based on such a model, a person will determine whether the benefits of a certain behavior are worth the costs in energy, time, effort, and other factors. This suggests, in developing communication strategies to guide park-related behavior, the messages should include identification of personal and social benefits of certain behaviors to create relevance to the park user.

**Reasoned Action and Planned Behavior**

Ajzen and Fishbein (1980) have proposed a model which indicates some behaviors are reasoned, or the result of conscious thought. They identify antecedent variables that influence people's intentions to behave in certain ways. These factors include (1) peoples' attitude toward a specific behavior (which is composed of [a] their beliefs that certain behaviors lead to specific results, and [b] their evaluation of the outcomes) and (2) a subjective norm (which is composed of [a] beliefs about what is normative behavior, particularly about what others who are important to them think about them for behaving in certain ways, and [b] their motivation to comply with those reactions or evaluations of others). For behavior that is reasoned and influenced by these factors, messages can be targeted to influence people's attitudes and beliefs in ways that will lead to behavioral intentions appropriate to the park setting (figure 1).

Recognizing that sometimes people ultimately behave differently than their intentions, Ajzen expanded the model to include the potential for a variety of variables, either totally or partially out of volitional control of the individual, to prompt a behavior different from actions originally intended. A variety of internal (e.g., individual differences in ability to exercise control over personal actions; information, skills and abilities of individuals; will power or strength of character; emotions and compulsions) and external variables (time and opportunity to behave in an intended manner; dependence on others for certain behaviors) can act as barriers to intended behaviors, even if a person actually tries to carry out the intended behavior. Thus, both a person's perceived and actual level of control over specific situations and behaviors may affect their ability to carry out the intended behavior. Sometimes a person may develop a specific plan for action, which incorporates ways to overcome some types of...
The person’s beliefs that the behavior leads to certain outcomes and his evaluations of these outcomes

Attitude toward the behavior

Relative importance of attitudinal and normative considerations

Intention

Behavior

Subjective norm

The person’s belief that specific individuals or groups think he should or should not perform the behavior and his motivation to comply with the specific referents


Figure 1. Ajzen and Fishbein’s Theory of Reasoned Action. (Arrows indicate the direction of influence within hypothesized relationships.)

barriers and can increase the person’s commitment to the intended behavior (figure 2).

Also important to the relay of information is the credibility of the information source (figure 3).

In park settings, communication can provide messages to create beliefs and understandings about the site’s resources and the results of certain behaviors. (For example, in a lakeshore setting, a message could describe increased wind
The person's beliefs that the behavior leads to certain outcomes and his evaluations of these outcomes

The person's belief that specific individuals or groups think he should or should not perform the behavior and his motivation to comply with the specific referents

Attitude toward the behavior

Relative importance of attitudinal & normative considerations

Intention

Subjective norm

Nonvolitional factors (internal and external factors that may interfere with intention)

Potential barriers to action

Person's perceived and actual level of control over nonvolitional factors (can be enhanced by developing adequate plan)

Behavior

The Theory of Planned Behavior expands the Theory of Reasoned Action beyond actions totally under volitional control to those for which the person's control over personal actions are influenced by a variety of internal and external factors which may serve to inhibit or change the intended behavior.

Source: Ajzen (1985).

Figure 2. Ajzen's Theory of Planned Behavior. (Arrows indicate the direction of influence within hypothesized relationships.)

and wave erosion through sand dune blow outs which were created initially by people walking over the dunes. Dune-walking damages vegetation which holds the dunes in place, thus creating starter channels, through which erosive wind and waves funnel). In such cases, it is important that visitors perceive the message givers as credible information sources.
Norm Activation

Schwartz (1977), who also believes a person's general cognitive structure (which includes their beliefs) influences behavior, proposes that socially developed behavioral norms create certain moral obligations within a person to behave in ways consistent with their beliefs. Feeding into the development of beliefs are two major factors: (1) a person's awareness of the consequences of certain behaviors, and (2) where they place responsibility for certain behaviors. In some cases, a person accepts personal responsibility for their behavior; in other situations, due to some external condition or constraint, they are in a sense...
forced to behave in ways counter to more normative behavior. In such cases, they deny personal responsibility and project it elsewhere, either to another person or a situational factor (figure 4). As cited by Vande Kamp et al. (1994), individuals might also fail to accept personal responsibility when they think someone else in a group will take care of it, thus diffusing the responsibility across a larger group of people. Elsewhere Vande Kamp et al. (1994) conclude awareness of consequences is more likely to have a positive effect on averting noncompliant behavior of visitors who perceive the impacts of compliant behavior will provide long-term benefits to both the resource, visitors, and other stakeholders rather than just to the rule-making agency.

![Diagram](https://via.placeholder.com/150)

**Diagram: Schwartz's Norm Activation Model**

- AC: Awareness of consequences
- AR: Ascription of responsibility
- (RD: Denial of responsibility)

*Source: Vander Stoep (1986), adapted from Schwartz (1977).*

*Figure 4. Schwartz's Norm Activation Model.*

Heberlein (1972) argues, even after people have developed a moral obligation to behave in a certain way, external factors can alter their behavior. These include situations in which they can shift blame to someone or something else, or in which they feel they have a low degree of choice in selecting behaviors. One example is people who blame a park agency for their littering behavior because trash cans were not readily available to them. Other examples are cutting across switchbacks, taking a shortcut across a bog, or camping in a...
fragile meadow because the other way is too far, or the sun is going down and there is no alternative, more appropriate place nearby to pitch a tent (figure 5).

AC: Awareness of consequences  
AR: Ascription of responsibility  
(RD: Denial of responsibility)


Figure 5. Schwartz’s Norm Activation Model (with Heberlein’s modifications).

In such situations, messages can be developed to give people information about the consequences of specific behavior and about appropriate alternative behaviors. Linked with this is the importance of informing people in a timely way so they can plan (and act) appropriately, and by providing reasonable behavioral alternatives (e.g., providing trash cans in easily accessible locations and designing routes that consider human travel tendencies).

Despite the general belief that norms play a role in decision making relative to resource-based behavior, much controversy has existed about norm existence and norm saliency (Donnelly et al. 1996). Norms may vary depending on personal perceptions, group influence, experience in a particular setting and with specific recreation activities, and whether the type of experience matched that which was preferred or expected (e.g., when hiking or trail biking).
Additionally, as new activities develop (often the result of development of new sports equipment such as trail bikes, personal watercraft, and in-line skates), new norms—or rules of appropriate behavior—must emerge. Heywood (1996) suggests a spectrum ranging from normative (based on social norms, such as bikers warning others when passing) to non-normative (based on social conventions such as skaters and bikers never moving side-by-side), and including emerging norms (e.g., skaters warning when passing) which often develop as a result of previous negative interactions.

Vande Kamp et al. (1994), from a literature search across several fields, have identified three general categories of norms that can influence behavior: descriptive norms (based upon and activated by what other people are doing), injunctive norms (based upon an individual's perception of what they think others believe should be done), and personal norms (injunctive norms internalized by an individual). The influence of norms on behavior is integrated in several models in this section. Vande Kamp et al. (1994), synthesizing from other authors, posit that a factor essential to the influence of norms on behavior is they must be activated, or made salient, at or close to the time and place at which the individual decides to behave in a compliant or noncompliant manner.

**Moral Development**

Dustin et al. (1989) propose people in recreational settings, just as in other places, make decisions and behave in ways consistent with their level of moral development. For each level of development, the influences (and therefore, effective strategies) change. The six levels discussed (based on Kohlberg et al. 1983) identify relevant primary influencing factors. Beginning with the lowest stage of moral development, these influencing factors are: (1) fear of punishment, (2) minimizing pain and/or maximizing pleasure, (3) concern about what significant others think, (4) concern about what society in general thinks, (5) concern about justice, fairness, equity, and (6) meeting personal expectations or convictions.

Dustin et al. (1989) suggest park messages used to guide behavior be matched to the level of moral development of the targeted group. In other words, efforts would be wasted by appealing to a sense of justice and fairness or living up to personal convictions for people (children, for example) who are in the lower stages of moral development and, thus, influenced most by external rewards and punishment. On the other hand, people operating at higher levels of moral development might be insulted by, and in fact react negatively to, fear messages. Accordingly, fines should not be used to discourage Stage 6 people from walking across sand dunes.

**Prosocial Behavior and Motivations**

Using elements of several theoretical models, Gramann and Vander Stoep (1987) present a hierarchical model of indirect management strategies for dealing with resource damage resulting from actions motivated by factors other than intentional destruction (figure 6). At the lowest level of this hierarchy are unintentional violations (which occur when visitors are not aware of a regulation, such as not swimming in a fragile area) and releaser-cue violations (such as carving initials on a tree or picnic table where other carved initials...
already exist). At the next level are violations that occur simply because people do not know certain behaviors cause damage (such as not knowing trail erosion is increased when walking on the edge of or off a trail to avoid mid-trail puddles, especially when many people do the same thing). At the third level are violations caused when people behave in ways they know might be damaging, but they can place the blame elsewhere (see the littering example in the norm activation section). At the top level are violations that occur from behaviors engaged in due to peer pressure or daring (such as dares to climb high into a tree, or steal a park relic or artifact).

This approach recommends developing messages and indirect strategies that match the motivation for the behavior. This can range from simply...
communicating rules and making visitors aware of negative consequences of certain behaviors to providing reasonable behavioral alternatives (providing trash cans along trails or building boardwalks over sand dunes), or giving visitors some of the responsibility for protecting the park resources so those feelings counteract damaging behavior motivated by peer pressure. Behaviors that intentionally cause damage (i.e., vandalism) or are illegal are not addressed in this hierarchy.

A Further Look at Motivations

Hendee et al. (1990) agree that behaviors resulting in resource damage can be motivated differently by different people in varying settings. They classify inappropriate behaviors as illegal, the result of carelessness (dropping matches or embers that start fires), the result of insufficient skills (creating fire scars or hanging lanterns on nails pounded into trees due to lack of knowledge or skills about minimum impact camping), uninformed (simply not knowing the rules or resultant damage caused by an action), or unavoidable (trampling a rare, endangered plant on a mountainside to retrieve a critical piece of gear that fell out of a backpack). Again, messages should be matched to the motivation or reason for the damaging behavior. Depending on a person’s reason for an action, communication will be variably effective at changing the behavior (figures 7 and 8).

<table>
<thead>
<tr>
<th>Type of behavior</th>
<th>Example</th>
<th>Persuasion’s potential degree of effectiveness**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illegal</td>
<td>Theft of Indian artifacts</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Invasion of wilderness by motorized off-road vehicles</td>
<td></td>
</tr>
<tr>
<td>Careless actions</td>
<td>Littering</td>
<td>++</td>
</tr>
<tr>
<td></td>
<td>Nuisance activity (e.g., shouting)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Noisy group encourages additional noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low maintenance levels encourage damage to public and private property</td>
<td></td>
</tr>
<tr>
<td>Unskilled actions</td>
<td>Selecting improper camping spot</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td>Building improper campfire</td>
<td></td>
</tr>
<tr>
<td>Uninformed actions</td>
<td>Selecting a lightly used campsite in the wilderness</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td>Using dead snags for firewood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Camping in sight or sound of another party</td>
<td></td>
</tr>
<tr>
<td>Unavoidable actions</td>
<td>Human body waste</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Loss of ground cover vegetation in the campsite</td>
<td></td>
</tr>
</tbody>
</table>


* Adapted from Hendee et al. (1990).

** Degree of effectiveness: + = low; ++ = moderate; +++ = high; ++++ = very high.

Figure 7. Roggenbuck’s chart of the potential of persuasion for reducing general undesirable visitor behavior.
<table>
<thead>
<tr>
<th>Type of behavior</th>
<th>Example</th>
<th>Persuasion's potential degree of effectiveness*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unintentional</td>
<td>Violation of quiet hours</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td>Entering a wildlife sensitive zone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Camping too close to a trail</td>
<td></td>
</tr>
<tr>
<td>Releaser-cue</td>
<td>Littering or litter encourages more littering</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Vandalism invites more vandalism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Noisy group encourages additional noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low maintenance levels encourage damage to public and private property</td>
<td></td>
</tr>
<tr>
<td>Uninformed</td>
<td>Hanging lanterns on trees</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td>Feeding wildlife</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Washing dishes and self in stream</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Building “rock circle” fireplace</td>
<td></td>
</tr>
<tr>
<td>Responsibility-denial</td>
<td>Littering</td>
<td>++</td>
</tr>
<tr>
<td></td>
<td>Failing to pick up others' litter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Failing to pay self-registration camping fee</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inadequate disposal of human body waste</td>
<td></td>
</tr>
<tr>
<td>Status-conforming</td>
<td>Smoking marijuana</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Drinking alcohol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exceeding game bag limits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carving initials in trees</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Graffiti</td>
<td></td>
</tr>
<tr>
<td>Willful violations</td>
<td>Breaking glass</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Driving off-road vehicles in wilderness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poaching wildlife</td>
<td></td>
</tr>
</tbody>
</table>

*Degree of effectiveness: 0 = none; + = low; ++ = moderate; +++ = high; ++++ = very high.

Figure 8. Roggenbuck’s chart of the potential of persuasion for reducing normative violations in park settings.

A Multidisciplinary Model

A multidisciplinary model of management for dealing with vandalism and depreciative behavior in recreation settings, presented by Knopf and Dustin (1992), combines elements of many of the ideas presented above. They state that a person, influenced by all kinds of social, physical, and managerial conditions, will have a certain propensity for engaging in resource-damaging behavior. An important distinction made between vandalism and depreciative behavior is whether the resulting damage is intentionally motivated or simply a side effect of another objective. This in turn influences which strategies will be effective. Based on their model, information and education are most influential in cases of depreciative behavior (unintentional) (figure 9).
Individual with Needs

Social Community System

Social Policy System

Management System

Physical Environment System

Propensity for Vandalism or Depreciative Behavior

Is it Intentional?

No

Depreciative Behavior

Information & Education Source Influences
- Message Influences
- Channel Influences
- Receiver Influences

Yes

Vandalistic Behavior

Norm Compliance Mechanisms
- Moral responsibility
- Identification
- Rewards

Direct Coercion


Figure 9. Knopf and Dustin’s model for the management of vandalism and deprecative behavior in recreation settings.

Communications and Other Indirect Techniques
Operant Conditioning

Synthesizing the work of applied behavior analysis (ABA) theorists, Vande Kamp et al. (1994) suggest that at least some behaviors (including some engaged in during visits to park and other resource areas) are guided primarily by learned behaviors based on rewards and punishment, with few or no intervening variables such as cognitive processing. While the punishment component is more applicable to the use of direct management techniques, and thus not covered in this paper, the use of rewards does have some application for indirect techniques. If a person believes they will be rewarded, intrinsically or extrinsically, for behaving according to regulations or standards of appropriate behavior (such as receiving feedback that most other visitors are staying on the trail), that person may be more likely to behave appropriately. Another way of applying ABA theory is to remove the rewards for inappropriate or noncompliant behavior. For example, if visitors are tempted to rub cave structures (stalagmites and stalactites) or to toss coins into hot springs to see how deep they are, managers might provide sample stalagmites at the cave entrance for visitors to touch, or provide a sign describing the depth of the hot spring pools. This approach is often called deflecting the inappropriate behavior to an appropriate target object or providing convenient, acceptable alternatives to reward-producing, but inappropriate, behavior. These strategies are discussed again elsewhere.

Simple Decision Rules

It has been suggested that not all behaviors engaged, including those, result from conscious, rationale decision-making processes (Vande Kamp et al. 1994). Rather, they may be the result of cognitive scripts or simple decision rules, which may be based on repetitive reaction to similar situations over time, or may simply be in response to broad personal rules for behaving, thus simplifying the decision-making process. Examples of simple decision rules might include simply doing what others in a person's group are doing, not doing things that will put the person in uncomfortable places (e.g., jail) or that will cost money (e.g., fines), not doing things perceived as or known to be dangerous to self or family and friends (walking off-trail to steep overlooks).

Heuristic Model for Understanding Affective Learning

Many internal, external, and intervening variables affecting decision making and behavior have been presented in previous models. Because awareness, understanding, and learning are important components of the communication process, managers must understand how people attend to, perceive, and interpret the messages they are presenting. Meredith et al. (1994) present a model, untested empirically at this time, that provides a conceptual framework for understanding how people learn, particularly in nonformal settings such as parks and recreation sites. The model identifies a sequence of events that occur, beginning with stimuli impinging on the visitor. For the person to attend to the message, they must first be attracted by some element (selective attention to some of the stimuli). The visitor then perceives or interprets the information in a personally understandable way. That person then makes an action decision (to stay at that place or message and explore further or to tune out and move onto...
other things). This decision will be influenced by the ability of elements of the message to hold the visitor. The model, which includes many other variables and steps, provides for both short and long-term affective responses. Short-term affect may initiate or reinforce long-term forms of affect, such as sentiments, attitudes, interests, values, and commitment. These forms of short-term affect may in turn serve as motivation for long-term patterns of behavior. If messages are to be effective, they must be designed to attract, hold, and provide accurate, unambiguous information to the visitor (figures 10, 11, and 12).

**Partnerships and Direct Involvement**

Partnerships with and direct involvement of site users or other stakeholders in developing resource use guidelines have become increasingly more important as resource planning and management tools. By their nature they involve much communication. Anticipated benefits include gaining support, trust, and cooperation of the users and stakeholders. Examples of these communication-intensive relationships include partnerships between management agencies and organized resource user groups such as snowmobilers and mountain bikers (Shuett et al. 1996; Pfister and Robertson 1996). While not all users of the sports equipment and resources are members of an organized group, members of these groups can help identify appropriate recreational behavior and provide input into development of policies and regulations to guide appropriate behavior. Also, members often participate in maintenance of the resource (e.g., trail maintenance, soil stabilization), communicate safety, stewardship, and appropriate behavior messages to group members and other users (they are likely to be perceived as credible sources), and often self-police fellow recreators.

Despite the potential and positive benefits of partnerships and public involvement, problems still exist that often place citizens at disadvantage: power imbalances, lack of decision-making authority, and perceptions of issue simplicity (Day and Wright 1996).

**Summary**

Several theoretical models have been described above. Integrated in them are many variables, both internal and external to the individual, that may influence a person to behave in particular ways. Some elements appear repeatedly across several theories, but may be integrated with other variables in slightly different ways or may be labeled with various names. The above models are provided to describe the multiplicity of variables that influence human behavior and to illustrate the many ways researchers have tried to integrate the variables and process to make sense of human behavior and to aid in predicting and managing behavior. Quite obvious is the fact that variables are so diverse there are no simple management guidelines, and that managers must carefully analyze their individual sites, audiences and objectives in developing appropriate resource management strategies. The following section provides examples of specific studies, many of them conducted in outdoor recreation settings ranging from front country to wilderness, which have attempted to isolate and assess the influence of specific variables and management techniques.
Source: Meredith et al. (1994).

Figure 10. Model of affective learning.

Communications and Other Indirect Techniques
Perception

Sensing

"Attracting" (focusing attention on a specific part of the stimulus field)

Formation of a "mental picture"

"Mental Picture" of stimulus

Sensory Capabilities

Attraction Factors

Internal
- Habituation
- Motivational state
- Need for stimulation
- Satisfaction and Fatigue

External
- Cognitive variables (novelty, complexity, surprisingness, etc.)
- Color, intensity, motion, size, sound
- Indicating stimuli (pointers, arrows, etc.)
- Modeling (seeing others attend)
- Proximity of stimulus
- Presence of competing stimuli
- Reward value of stimulus
- Sensory mode of stimulus

"Mental Picture" Factors

Internal
- Motivational state
- Emotional state
- Experience, knowledge, and intellect
- Long-term affective dispositions

External
- Length of time of exposure to stimulus
- Temporal and spatial patterning of stimulus

Source: Meredith et al. (1994).

Figure 11. Detailed view of the perception process and the attraction and "mental picture" factors of the model.

Communications and Other Indirect Techniques

109
So What Is It That We Do Know? Some Specific Research Results

Since the early 1970s, some research has been conducted in parks and other natural resource settings to determine the effectiveness of indirect management techniques. Results of this research can provide some insights into potential application of management techniques. A critical issue is to recognize and consider the context and potential constraints when making resource management decisions. One factor to consider is most research conducted has occurred in primitive or wilderness contexts (Roggenbuck and Ham 1986), thereby limiting its generalizability to other settings and contexts. When comparing results from more than one study, often the results may seem contradictory or unclear. Several potential reasons, which should be recognized when considering application of research results in a new setting, include:

Source: Meredith et al. (1994).

Figure 12. Detailed view of the action decision process and decision factors of the model.
• different contexts, settings, visitor characteristics;
• different variables included, assessed, and/or controlled;
• different levels or specificity of data;
• different objectives of research studies (often resulting in different ways of asking questions or collecting data);
• differences in some component of the research treatments (such as time, place, consistency of application);
• poorly conceived or biased research design.

However, as a result of studies conducted both inside and outside the resource management arena, some general guidelines about use of communication as a management tool have been determined:

• Messages should be targeted to specific audiences rather than being generic, through use of a scatter-gun approach. Messages should consider and match motivations of the targeted visitor(s).

• All of the following components of communication influence effectiveness: a message content, message channel, characteristics of the message receiver (e.g., the park user), credibility and characteristics of a message source (e.g., the ranger or agency), when an individual receives a message relative to the lead time needed or not needed to decide to act (e.g., while planning a park visit, soon after arrival on site, or after already engaging in a particular activity).

• Communication strategies should occur both on-site and in outreach settings (repetition and varying contexts help reinforce messages much as advertising jingles and logos are used across various media).

• Direct involvement of targeted park visitor/user groups (and local community groups) should be incorporated with information dissemination because it promotes sense of ownership, responsibility, and commitment.

• Youth should be a primary targeted group because many of their values and behavior patterns may not be as well established as adults' and youth can often influence adults' behavior.

• Messages should include descriptions of management problems, costs, and other impacts of the problems, particularly as directly relevant to the targeted visitor or community group. This aids in understanding and gives both credit and responsibility to the target audience for personal decision making and behavior.

• Messages should be relevant to the user/community group.

• Messages should be presented in a positive, respectful way which allows people to take responsibility for their decisions and actions rather than in an authoritative, dictatorial way which implies removal of personal freedom of choice.

*Communications and Other Indirect Techniques*
• Message channels and sources should take advantage of information sources preferred and/or already used by target audiences; sources should be perceived as credible and trustworthy.

• Indirect techniques should be varied and possibly combined with design elements and direct management techniques because visitors are diverse in motives, perceptions, experience, and many other characteristics.

• Releasor cues for inappropriate or noncompliant behavior should be removed while visual cues for appropriate or compliant behavior should be provided.

Information about effectiveness of specific elements of various media types abounds (such as effectiveness of signs being affected by elements of placement, color, layout, lettering styles, lettering sizes, graphic elements, textures, contrasting/competing visual elements, angle of sign placement, complexity of text and/or graphics). However, all these details are beyond the scope of this paper. Such information can be found in textbooks and guidebooks on interpretation, graphic design, publication layout, writing, etc., as well as in research publications such as the quarterly Visitor Behavior, published by the Visitor Studies Association (POB 1111, Jacksonville, AL, 36265) and in Research Abstracts from Related Literature, a column which appeared regularly beginning in late 1993 in Legacy, the Journal of the National Association for Interpretation. Also see Brunswick et al. (1995) and Trapp et al. (n.d.).

Sometimes managers may want to communicate a message about a management policy or management technique rather than simply facilitate resource-protective behaviors. Such messages hopefully increase awareness and understanding of complex management issues and policies and, hopefully, decrease confusion, anger, and animosity in targeted audiences. An example was the need for park managers to explain fire management policy to appropriate stakeholders and visitors after the 1988 Yellowstone fires (Fleener and Ruddell 1996). In this case, there was need to select a controlled medium (as opposed to uncontrolled local and national media) and make the message relevant to the audience. A multimedia concert, “The Music of Nature: A Concert for Yellowstone,” used visual images, music, and both spoken and printed words, because such a format is a preferred and effective entertainment medium and can reach a diverse audience. Another example is the use of a Connecticut Public Television documentary, combined with other outreach efforts and collaborative projects to educate a community about coastal and marine issues and to enlist their involvement in coastal resource use decisions (Bender 1996; Bender et al. 1996).

More specific information gleaned from a variety of research studies involving use of indirect management techniques are found in table 1.

In summary, multiple studies, with varying results, indicate that many variables, under differing situations (including a message channel, way information is presented, clothing worn by the ranger, gender, personality, experience, source and amount of information, strength of the argument, timing, characteristics of
Table 1. Research Results Related to Indirect Management Techniques

<table>
<thead>
<tr>
<th>Findings</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Irwin 1985</td>
</tr>
<tr>
<td>Variables of time, place, recreation experience type, and type of informational contact can influence preferences for and effectiveness of information (varied results and recommendations depending on setting and other contextual factors).</td>
<td>Wang et al. 1996</td>
</tr>
<tr>
<td>Indirect information/education management tools should be used in conjunction with other techniques.</td>
<td>Chavez 1996</td>
</tr>
<tr>
<td><strong>Message Channel</strong></td>
<td>Washburne and Cole 1983</td>
</tr>
<tr>
<td>In general, personal contact with recreationists is perceived by resource managers in various agencies to be the single most effective medium for effective communication with park visitors, including in the backcountry (for a variety of management goals, including better dispersal of campers and better [minimum impact] camping techniques).</td>
<td>Martin and Taylor 1981</td>
</tr>
<tr>
<td><strong>Message Sources</strong></td>
<td>Linares and Lucas 1977</td>
</tr>
<tr>
<td>Sometimes, simply the presence of uniformed rangers can influence visitors to behave in compliant ways and avoid noncompliant behavior, such as not walking off designated trails.</td>
<td>Canon et al. 1979</td>
</tr>
<tr>
<td><strong>Message Channels</strong></td>
<td>Lucas 1981</td>
</tr>
<tr>
<td>Message sources should be credible, attractive, portray a position of power or authority, trustworthy, and, if possible, similar to the target audience.</td>
<td>Roggenbuck and Berrier 1982</td>
</tr>
<tr>
<td>Message channels and sources chosen should match those preferred or already used by the target audience. One preferred source of most target audiences, word of mouth, is difficult to control. However, specific target audiences prefer specific sources and media formats. For example, boaters prefer marinas and marina operators, and brochures and pamphlets for receiving information about pumpout stations. In one study, horseback riders prefer signs and trailhead maps, but rarely use guidebooks, brochures or topographic maps.</td>
<td>Widmer and Roggenbuck 1996</td>
</tr>
<tr>
<td>While printed information (such as brochures) can reduce some violations (e.g., hammering nails in trees, causing damage to statues and monuments by climbing and rubbing), when combined with a message delivered by a person (ranger), the negative behaviors are reduced considerably more.</td>
<td>Roggenbuck et al. 1982</td>
</tr>
<tr>
<td>To even have a chance of being effective, messages must first be read or heard by targeted park visitors; studies show that brochures are not always read (e.g., one-third of campers read brochures about not littering that were distributed with camping fee validations).</td>
<td>Swearingen and Johnson 1988</td>
</tr>
<tr>
<td>In other studies comparing effectiveness of various communication channels (including brochures, signs, taped messages, slide programs, guided tours, and other types of personal contact with rangers), results are varied both with regard to increasing some kinds of knowledge and influencing behavior.</td>
<td>McGuire 1985</td>
</tr>
<tr>
<td></td>
<td>Hovland and Weiss 1952</td>
</tr>
<tr>
<td></td>
<td>Talhelm et al. 1996</td>
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<tr>
<td></td>
<td>Marsh and Burde 1995</td>
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<td></td>
<td>Oliver et al. 1985</td>
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<tr>
<td></td>
<td>Vander Stoep and Gramann 1987a</td>
</tr>
<tr>
<td></td>
<td>Roggenbuck and Berrier 1982</td>
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<td></td>
<td>Marler 1971</td>
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<td>Feldman 1978</td>
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<td></td>
<td>Fazio 1979a,b</td>
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<td></td>
<td>McAvoy and Hamborg 1984</td>
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<td></td>
<td>Barget 1984</td>
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<td></td>
<td>Matheny 1978</td>
</tr>
<tr>
<td>Findings</td>
<td>Authors</td>
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<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td><strong>Message Channel (cont.)</strong></td>
<td></td>
</tr>
<tr>
<td>Use of concessionaires and guide service staff who have direct, personal contact with park visitors (such as river raft guides) can extend the communications arm of the management agency and provide important safety, guide, and interpretative information to visitors.</td>
<td>Roggenbuck and Bange 1983</td>
</tr>
<tr>
<td>Use of rangers in backcountry settings is NOT intrusive on most people’s wilderness experience; in fact, it is often viewed as appropriate and desired.</td>
<td>Wang et al. 1996</td>
</tr>
<tr>
<td>Sometimes multimedia formats—familiar to many people, including nonpark users—can effectively reach a diverse audience and tap into many sensory, emotional, and cognitive domains (e.g., multimedia concert using music, visual images, spoken and written words to present fire management issues and policy after Yellowstone fires).</td>
<td></td>
</tr>
<tr>
<td>Sometimes the same messages can have different effects at different times and with different audiences. In a study comparing the effectiveness of a sign and personally delivered message on visitors’ valuation of interpretive messages, results were mixed across two years.</td>
<td></td>
</tr>
<tr>
<td><strong>Message Content/Type</strong></td>
<td></td>
</tr>
<tr>
<td>In some situations and with some visitor types, simple knowledge of rules and appropriate behavior (obtained through brochures) is sufficient to reduce rule violations and inappropriate behavior; however, in other settings, and with some user types (such as children), just knowing proper behavior is not enough.</td>
<td>Ross and Moeller 1974</td>
</tr>
<tr>
<td>If threatened sanctions or other harmful results (such as fines or tickets for walking off designated trails) are explained, and the more likely and the more serious the harm, the less the behavior will be engaged in. (These may be called fear appeals.)</td>
<td>Gallup 1981</td>
</tr>
<tr>
<td></td>
<td>Young and McDonough 1985</td>
</tr>
<tr>
<td>If a “fear appeal” is serious, probable, and relevant (e.g., contracting bubonic plague and other diseases when feeding squirrels), it will be more effective than a “moral appeal” (e.g., feeding people food to squirrels is harmful to them), though each reduces the inappropriate behavior. Related studies indicate messages should be interesting and relevant to the visitors.</td>
<td>Petty and Cacioppo 1981</td>
</tr>
<tr>
<td></td>
<td>Schwarzkopf 1984</td>
</tr>
<tr>
<td>When managers request specific restricting or guiding behaviors, it is important the managerially preferred behaviors are reasonable and easily doable (e.g., when asked to make camp in lesser used sites to reduce impact, campers were less likely to change their plans if little daylight was left [an unreasonable alternative] than if there was plenty of time to proceed further).</td>
<td>Roggenbuck and Berrier 1982</td>
</tr>
<tr>
<td>Signs that contain a number of social influence statements, from sanction messages to ethical appeals, provide visual images of consequences of rule violations and encourage visitors to take responsibility for their behavior are effective in reducing theft of petrified wood.</td>
<td>Widner and Roggenbuck 1996</td>
</tr>
</tbody>
</table>

**Communications and Other Indirect Techniques**
Findings

Visitor Characteristics and Social Context
Young and infrequent visitors know less about site rules than older, repeat visitors and, thus, are more likely to violate the rules; therefore, they should be primary targets for information.

In at least one study, inexperienced or first-time users of a site were more likely than experienced groups to change their campsite destination in a wilderness area in response to ranger-presented messages about dispersing campsite use (though overall impact was minimal).

Gender can play a role in effectiveness of message channels. In one study, uniformed rangers were equally effective for males and females, though signs and signed pledge forms were more effective with females than males in reducing incidents of taking petrified wood.

Crowding, one of several potential distracters to message reception, was found not to have an impact on visitors’ valuation of an interpretive message.

Individuals aware of negative environmental impacts of using over-sand vehicles (OSVs) on barrier beaches and dunes and who ascribed at least some of the responsibility of impacts to themselves were more willing to accept restrictions on use of OSVs; on the other hand, others found that awareness of consequences and personal ascription of personal responsibility were insufficient predictor variables for use of off-road vehicles (ORVs) in a seashore environment.

Persons in large groups are more likely to engage in noncompliant behavior than those in small groups.

Larger groups were more likely than small groups to change their campsite destination in a wilderness area in response to ranger-presented messages about dispersing campsite use (though overall impact was minimal).

Other Indirect Techniques

Releasor Cues. Environmental cues, also called releasor cues (such as evidence or traces of other people’s behavior in a specific setting . . . such as carving on trees, littering, handing lanterns on trees), can promote inappropriate behavior. Also, the more visible the policing authority, the less likely these behaviors are to occur.

Visual Cues to Appropriate/Inappropriate Behavior. Site design and structural cues (such as providing paved walkways to indicate proper travel patterns, or provision of rope or split-rail or stone barriers to indicate staying on trails) can decrease the amount of noncompliant behavior (such as shortcutting or otherwise walking off-trail).

Deflection of Behavior. Sometimes deflection of inappropriate behaviors from the natural or cultural resource to a sacrifice area where the behavior is allowed (such as providing a carving log, graffiti rock, cave formation to touch) can be effective in reducing damage to the rest of the resource (informal observation only).

Communications and Other Indirect Techniques

Authors
Ross and Moeller 1974
Halstead et al. 1991
Halteet and Roggenbuck 1996
Waltz et al. 1996
Vaske et al. 1990
Noe et al. 1982
Swearingen and Johnson 1988
Vande Kamp et al. 1994
Swearingen and Johnson 1988
Sandahl and Christensen 1985
Crump et al. 1977
Swearingen and Johnson 1988
Christiansen 1983
Vande Kamp et al. 1994
**Other Indirect Techniques (cont.)**

**Personal Involvement.** Personal involvement (by being given instructions on specific actions to take to help reduce inappropriate behavior, such as reporting damage/damaging behavior to statues and monuments or reporting littering violations of others) can both reduce the individual's inappropriate behavior as well as increase reporting. Creating a link and building trust between the visitors and managers is a component of this process.

When park visitors voluntarily signed a pledge agreeing not to remove petrified wood theft rates dropped significantly.

Personal involvement through partnerships between management agencies and resource users/organized groups can facilitate appropriate resource behavior.

While partnerships have potential and benefit, problems such as power imbalances and lack of real authority can negatively affect the relationships and, consequently, behaviors related to resource management and use.

**Incentives.** Rewards or incentives for appropriate behavior can (under some conditions such as with children and some adults) reduce negative behavior (such as littering) or encourage positive behavior (such as picking up the litter of others).

... HOWEVER Under other conditions (such as with adults who already have an internalized attitude toward the appropriate behavior, such as not littering, or using minimum impact camping techniques), people can react negatively to incentives (called the boomerang effect).

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**Findings**

**Authors**

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While studies on the use of communications as a management tool have been conducted, some researchers have determined that little hard research data exists (Roggenbuck 1992; Knopf and Dustin 1992). Even if a manager can find a single related research study identifying a successful management technique, there are potential problems in assuming similar success when applying the results to another setting. Sharpe (1982) cautions that "what works in one situation may not in another, and reading the available literature on the subject will not necessarily provide a specific solution." Citing Roger Clark, Sharpe continues, "to urge caution in searching the literature for 'an answer to vandalism,' pointing out that there is no single solution to the problem. He suggests that the manager weigh each 'solution' carefully in terms of the specific situation identifying unsubstantiated claims and avoiding reliance on data that are the result of poorly conceived research."

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116

**Communications and Other Indirect Techniques**
So What Is It That We Do NOT Know?

Two general and related conclusions can be drawn from the review of what is known about the effectiveness of information, education, interpretation, and persuasion:

1. These interventions are effective for some problem behaviors, but not for others.
2. These interventions are effective in some situations, but not in others.

Much of what is not known relates to the need to understand these differential effects, and what it is about the recipient, the behavior, the context, the source of the message, or the message itself that influences the effectiveness of information, education, and persuasion in natural resource settings. Discussed below are some questions and gaps in knowledge about use of communication and other indirect management tools. To provide clarity, discussions are presented within the context of what is known about certain variables. Therefore, some previous discussions about "what we DO know" are summarized briefly.

Motivation for the Problem Behavior

Hendee et al. (1990) have classified problem behaviors in resource settings as illegal, careless, unskilled, uninformed, or unavoidable, and Roggenbuck (1992) has suggested that persuasion likely has very high or high potential to reduce uninformed actions and unskilled actions, moderate value for reducing careless actions, and little value for illegal or unavoidable actions. Gramann and Vander Steep (1987) suggest another typology of depreciative behavior in park settings based upon motivations for actions: unintentional, releasor-cue (i.e., seeing others do impacting acts or behavior traces of such acts), uninformed, responsibility-denial, status-confirming (e.g., performing a depreciative act to gain access to a group), or willful violations. Roggenbuck (1992) again rates the potential of persuasion in reducing these varying problem behaviors based upon their motivation. For example, he states that information interventions have high or very high value in reducing uninformed or unintentional acts, moderate value in eliminating responsibility-denial behaviors, low value in reducing releasor cue behavior or willful violations, and no value in lowering status-confirming depreciative acts.

These classifications of problem behaviors based on their underlying motivational structure would seem to have value for the application and testing of persuasive communication interventions; but it is not known with any degree of certainty which specific acts belong to which class of motives, and what type of persuasive intervention would likely work best for each of the motive-behavior classes.

Level of Ethical Reasoning

Dustin et al. (1989) have recently suggested that individuals decide on what behaviors are right or wrong based on one or more of six levels of moral reasoning: fear of punishment, what is best for me, what peers and significant
others think, what is the common good (i.e., what does society ask of me?), a principled evaluation of the ethical rationale for or against a given behavior, and an established lifeway of acting according to universal ethical principles. He suggests deprecative behavior in park and forest settings has its basis in one or more of these levels of moral reasoning, and for interventions to be successful, they must address the relevant ethical basis for the behavior. However, we have done little research in park settings to identify these rationales for problem behavior.

Degree of Reasoned, Thoughtful or Planned Action

Fishbein and Manfredo (1992) have noted some behaviors are reasoned and some are spontaneous or thoughtless. For reasoned behaviors, understanding attitudes, beliefs, and norms about them are useful in predicting the behavior. The behaviors also can be changed by altering attitudes or beliefs, or by differentially activating norms. However, for those actions which are more routine, thoughtless, or spontaneous, an entirely different route to behavior change is necessary. For example, logical arguments and necessary content becomes less important (because the recipient is not attending to these arguments). Instead, the actor in this situation uses simple decision rules on how to act, such as the apparent expertness of the source of the communication.

This conceptual model of behavior change has enormous implications for park visitor management. Managers and researchers often believe park visitors attend to, process, and integrate persuasive messages and, therefore, expect behavior change. But the park visitor is often in a novel situation, in a hurry, and in a crowded, noisy situation. These variables all point to the need for greater emphasis on understanding the rote decision rules the park visitor uses on how to act, and on finding ways to tap into these routine decision-making strategies. But virtually no research has been done on which park visitors, in what situations, and for what actions use a central or thoughtful route to decision-making, or instead use a more thoughtless or peripheral path. Depending upon which route is used, an entirely different persuasive or communication intervention is called for.

Accessibility of Attitudes

Related to the central (thoughtful) versus peripheral (use rote decision rules) route to decision-making is the extent to which an individual accesses an attitude in a given decision situation. A park visitor may know and feel positive about a given behavior, but if they do not access or use that attitude at the moment of decision, that attitude will not shape behavior. If so, it does little good for the park managers to address that attitude in persuasive messages.

But it is not known what type of visitors, for what behaviors, and in what contexts attitudes are useful predictors of behavior and when they are not. Interventions that increase the accessibility (or behavior-influencing value of attitudes) have not been tested, although such techniques are available (Vincent and Fazio 1992).
Degree of Norm Activation

In any social setting like a park, there are group norms (i.e., standards of appropriate behavior shared by the group) regarding appropriate park behavior. These norms vary in the extent to which they are well articulated (i.e., known and shared) across all park visitors. Also, while norms act to ensure appropriate and predictable behavior, they vary in their effectiveness. Park managers can act to foster the shared acceptance of appropriate norms, and can foster their activation in ambiguous behavioral situations (which are common in parks). For example, park managers can role-model proper behaviors, and can enlist the support of various groups in the park to pick up litter, recycle trash or report violators—and do this in a way that is visible and known to other park visitors. But in visitor management interventions little tested the role and appropriateness of norm activation and peer pressure to accomplish park protection goals.

Behavior Change (Modification) Strategies

The behavior change strategies or theories of applied behavioral analysis (Winett 1992; Roggenbuck 1992) typically are not viewed as an indirect visitor management strategy (i.e., not viewed as information, education, or communication). But they are a type of persuasion and deserve mention here. Typically, these interventions shape behavior by reward or punishment. These strategies commonly are used in park settings, although punishment (e.g., fines) is used far more often than rewards. But incentives for picking up litter and carrying out trash from the backcountry have been tested (Clark et al. 1972a,b; Powers et al. 1973; Vander Stoep and Gramann 1987a,b), with varying degrees of effectiveness. There is a need to know more about the reasons for success and failure of incentive systems. For example, which visitor groups and what types of behavior can be shaped by incentives, which incentives are effective, and what is the stability of learned behavior due to incentives across time?

Another behavior change intervention common to applied behavioral analysis is the use of antecedent conditions to shape behavior. For example, by appropriate park design or maintenance, the park manager can give appropriate cues to elicit appropriate park behavior. Examples would be clean restrooms or not mowing native grasses and flowers on roadsides. More research is needed to understand better how environmental and behavioral cues by park managers shape visitor behavior and to inventory current park settings to identify inappropriate cues. Then steps can be taken to make certain environmentally and experientially sensitive cues are provided or inappropriate ones removed.

Types of Target Behaviors

Much of the past research on the use of information and education to change behavior in recreation settings has focused on use dispersal and redistribution of use within a park or wilderness setting (e.g., Roggenbuck and Berrier 1982; Lucas 1981; Huffman and Williams 1987). These attempts have been highly successful, but doubts remain. First, some have questioned the appropriateness of these interventions by suggesting the elicited behavior changes may have
caused more problems than they solved (Cole and Benedict 1983). For example, while the use redistribution may have solved problems of crowding and congestion, it likely spread out and increased overall environmental impact. More germane to this analysis, there have been far fewer analyses of the use of information, education, communication, and persuasion to reduce individual acts of impacting or depreciative behavior in park settings. More tests of these interventions to reduce depreciative behavior are needed and, equally important, assessment of the stability or long-term endurance of any positive behavior changes elicited in park settings must be monitored.

Teaching an Environmental Ethic

Most empirical tests of the effectiveness of persuasive interventions in recreation settings have focused on specific behavioral responses to messages targeted at the specific behavior in a specific setting. This makes sense both from a theoretical (i.e., messages to change behavior should focus on the specific behavior to be changed) and from a measurement (i.e., the need for control to eliminate other explanations besides the informational intervention as the cause of behavior change) standpoint. But the park manager is left with the question of whether the informational intervention will work in their setting and, more important, whether the park visitor can take what they learned from the educational intervention in one context or setting and apply it appropriately in another. For example, if backcountry campers learn how to select the ideal spot to locate their camp from a persuasive intervention in Isle Royale National Park, will they make the right decision in Voyageurs National Park or Big Bend National Park? We simply do not know.

Characteristics of the Recipient, Source, Message, Channel, Timing, and Context

Theoretical and empirical work on persuasive messages demonstrates the recipient of the message is not a passive listener. Instead, the listener (e.g., the park visitor) can normally choose to be exposed or not exposed to the message, can attend or not attend to the message, can and will massage the message in their own mind, will or will not integrate the message with existing belief sets, may or may not store the message in memory, and finally may or may not act upon it. Viewing the listener as an active agent is a more accurate reflection of the information processing beings that humans are. It also calls for more complex and integrative models and tests of the effectiveness of persuasion in park settings than have been conducted in the past.

For example, such characteristics of the park visitor as interest in the message, motivation to listen, ability to understand the message, involvement with the message, ability to do the recommended behavior, and feelings of self-efficacy (empowerment to act to satisfy individual needs) all will likely influence success of park messages. The source, too, is important, especially if the recipient has little time or ability to think through carefully the strength of message arguments. In this situation, the recipient more likely will act on whether the message source is perceived as an expert or is attractive. The setting influences the way a recipient processes messages. For example, in noisy settings with lots
of distractions, the recipient is less likely to attend to the message and give it careful thought. In this situation, they are much more likely to rely on rote decision-making rules, like the authority or apparent expertise of the source. On the other hand, if the listener has time, motivation, and ability to process the message thoughtfully, then argument strength, relevance, and novelty all become far more important to the ultimate behavioral decision.

Two other intervening variables shape the success of the persuasive messages in the interpretive context: timing and channel used. Park visitors must receive the message early enough in their trip planning process to be able to respond to it. For example, telling the park visitors when they arrive at the park that they must use a backpack stove in the backcountry may be too late to gain compliance. Also, informing the backcountry visitor of a regulation assigning people to backcountry campsites when they arrive at the park may be too late to avoid resistance. Research suggests that personal contacts are often more effective than the written word of a brochure in changing park behavior, but this is not always the case (Roggenbuck and Berrier 1982).

While most recreation research on the effectiveness of information, education, and persuasion in reducing problem behaviors in parks has focused on these contextual problems, study findings lack consistency. Some of these differences likely result from the varying research methods used, but at least two other research deficiencies are apparent. There are characteristics of the message (e.g., strength of message arguments), the source (e.g., perceived expertise, role of the uniform in establishing credibility), the recipient (e.g., ability to understand the message, information processing ability), channel used (e.g., importance of two-way communication, effectiveness of user-friendly computers to provide information tailored to a visitor's individual needs), and the situation (e.g., presence of distractions such as a noisy visitor center) that have not been studied adequately. Second, a comprehensive research strategy is needed which permits analyses of the influence of these contextual variables holistically, i.e., research must lead to discovery of how these variables interact in a natural setting to shape the effectiveness of communication in changing park behavior.

**Persuasion and Freedom**

Indirect visitor management strategies such as information, education, and persuasion are often recommended to park managers because they work, are lighthanded, and are preferred by visitors over more direct behavioral interventions. Some visitor opinion surveys indicate communication and informational contacts with rangers are preferred management actions (e.g., Irwin 1985). But almost no research has addressed whether the park visitors perceive persuasive interventions to be lighthanded. It may be that park visitors feel as compelled to obey a persuasive suggestion from a friendly ranger as they do to respond to an authoritarian sign. If one of the values and prerequisites of high quality leisure experiences is to maintain a sense of freedom, there is a need for research to examine park visitors' evaluation of perceived freedom under the various persuasive interventions discussed in this paper. That has not yet been done.

*Communications and Other Indirect Techniques*
Some Suggested Research Projects

This paper concludes with a list of research projects that might be considered for filling some gaps in knowledge related to use of indirect techniques for managing visitors in park or other outdoor recreation settings. This list is not meant to be all inclusive, nor does it represent a priority ordering of the needs for research on the use of information, education, and persuasion as a management tool. It is instead a point of discussion from which readers can add, subtract, or embellish based upon their own knowledge of park and other recreation resource management settings.

Possible Research Projects

- Describe the nature and motivation of visitor behavior problems in the park.
- Determine what classes or types of depreciative behaviors are amenable to change through information, education, and persuasion.
- Determine what level of ethical reasoning regarding appropriate park behaviors is common to various segments of the visitor population and what kind of persuasive intervention is appropriate for which level of ethical reasoning.
- Determine which depreciative behaviors or problem behaviors are thoughtful or reasoned, which ones are spontaneous or routine.
- Determine the importance of argument strength and what makes for message strength in reasoned attempts to change problem behaviors.
- Determine under what situations knowledge, beliefs, or attitudes shape behavior, especially problem behavior, in park settings.
- Determine under what conditions attitudes are accessible (i.e., used to decide appropriate behavior) and how attitudes can be made more accessible.
- Determine ways for the park manager to gain greater attribution of expertise or attractiveness in the context of persuasive messages to change behavior.
- Identify the norms of various clientele groups among the park visitors regarding low impact behaviors, and determine how park managers can activate appropriate norms of certain clientele groups to bring pressure to bear upon nonconforming groups.
- Determine under what conditions incentives, rewards, and punishment are appropriate in shaping park visitor behavior; determine the relative effectiveness of each of those strategies; and determine which, if any, results in long-term behavior change.
- Identify what messages are given to the park visitors about appropriate park behavior based on environmental cues (e.g., design and maintenance standards), and how these cues shape behavior.
• Determine whether information, education, and persuasive techniques found effective for problem behaviors in wilderness settings also can be effective in more developed and heavily visited park areas.

• Determine effectiveness of information, education, and persuasion programs in park settings in teaching a long-term low impact ethic.

• Determine which visitor characteristics, including cultural differences, and in what situations, influence the effectiveness of information, education, and persuasive communication.

• Identify which channels of message transfer are most effective in shaping visitor behavior and why.

• Determine longevity or persistence of messages (presented in brochures, signs, by rangers) to future situations in which the same noncompliant behavior may be engaged.

• Determine what types of information, education, and persuasion shape perceived visitor freedom and quality of leisure experiences, in what ways, and why.

Some Other Issues to Consider

Recognizing resource and visitor management problems, and identifying social science research projects which can provide insight and recommendations to managers provide an important beginning to effective use of social science as a tool to identify effective management strategies. But this is only a beginning. Some other things that should be kept in mind, and worked toward, include:

• developing close and continued coordination between park and other resource managers to identify and prioritize mutual problems and research needs so unnecessary duplication of effort and resource expenditure do not occur;

• developing working relationships between managers and researchers to identify and understand the various constraints (budget processes, operations calendars and time constraints, staff and resource availability, reporting systems, political frameworks, etc.) under which each group operates;

• developing and sharing a common language where it does not already exist;

• incorporating social science as an integral part of the park planning process and park management plans;

• facilitating ongoing discussion and information flow between researchers and managers; and

• developing a better system for disseminating research results in a timely manner and in a usable format to front-line managers as well as to regional decision makers.
Literature Cited


Communications and Other Indirect Techniques


*Communications and Other Indirect Techniques* 125


130

*Communications and Other Indirect Techniques*


Additional Relevant Readings


Communications and Other Indirect Techniques 131


The Potential of an Expert System to Address Congestion and Crowding in National Park System

Gregg Flekke, Leo McAvoy, and Dorothy H. Anderson

Introduction

Information and knowledge transfer are important issues in every field, including business, education, and recreation resource management. There has often been a breakdown in the knowledge transfer from researchers to the actual managers who have to use the latest information to make management decisions. Anderson and Morck (1986) looked at a number of studies and summarized this problem of information transfer between recreation researchers and managers as: research findings are often not organized to be useful to managers; research findings are sometimes not applicable to the diverse everyday problems managers face; and published research findings often do not meet the needs of managers (Lingwood and Morris 1976; Lundgren 1981; McCool and Schreyer 1977; Roggenbuck and Watson 1982). Conditions have not improved very much since McCool and Schreyer (1977) or the Anderson and Morck (1986) analysis of the literature ten years ago.


2 Respectively, Electronics Instructor, Dunwoody Institute, 818 Dunwoody Blvd., Minneapolis, MN 55403, <gretle@dunwoody.tec.mn.us>; Professor, Division of Recreation, Park, and Leisure Studies, University of Minnesota, 203 Cooke Hall, Minneapolis, MN 55455, <mcavo001@maroon.tec.umn.edu>; and Associate Professor, Department of Forest Resources, University of Minnesota, 115 Green Hall, 1530 Cleveland Avenue North, St. Paul, MN 55108, <dandcrso@forestry.umn.edu>.
A recent approach to facilitating information transfer in various fields has been through computerized “expert systems.” These are computer programs which communicate knowledge and information from so-called experts to nonexperts. Expert systems have been defined as “a computer program designed to make recommendations and draw conclusions based on a set of rules derived from human experts” (Barker 1988); and “a system that employs human knowledge captured in a computer to solve problems that ordinarily require human expertise” (Turban 1990). These systems incorporate knowledge about a specific issue from the literature and from experts in the field, and serve as a kind of consultant to help field personnel make a logical decision regarding a management problem.

Expert systems are more than a computerized database or loosely structured computerized aid. Expert systems can aid the manager by simulating the advice of experts such as that made by making a phone call to a consultant (or a researcher) to get advice making a certain decision. Expert systems not only give advice, but by communicating knowledge they can inherently improve decision making. “The innovation-decision process is the process through which an individual (or other decision-making unit) passes from first knowledge of an innovation, to forming an attitude toward the innovation, to decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision” (Rogers 1983). While the expert system can function like an expert consultant, the knowledge and advice within the system are at the hands of the manager. The manager can decide to accept or reject the results of the computer-generated expert advice. Expert systems have been used successfully, for example, in business (Kader 1992); forestry (McRoberts et al. 1991); pollution control (Lai and Barthouex 1990); fire management (Schmoldt and Bradshaw 1988); and wildlife management (Buech et al. 1990). They have not been widely applied in recreation resource management.

Developing and Evaluating the Expert System for Crowding

The purpose of the project reported in this paper was to develop a prototype expert system to address the management issue of crowding in the national parks, to have this expert system evaluated by National Park Service (NPS) managers, and to generate recommendations on the use of expert systems to help NPS managers solve crowding problems in the parks. Crowding was the central issue addressed at the workshop around which the papers in this publication are focused. The attendees at the workshop participated in the evaluation of the expert system on crowding.

The expert system developed in this project was meant to give advice and stimulate the process of consultation with experts on the issue of crowding in national parks. The system represented a process of gathering information about crowding, the scope of the problem, and then matching the problem with selected solutions encoded within the system. Level 5 programming language was used as a system shell for this expert system (Barker 1988; Billman and
The construction of the expert system initially meant finding relevant crowding information and knowledge from the literature and encoding it into rules that would lead a system user to a recommendation about how to solve a particular crowding problem. The sources on crowding were journal articles, texts, and management guides, including material from: Bratton et al. (1979); Cole (1983a,b); Cole et al. (1987); Hammitt and Cole (1987); Shelby et al. (1989); and USDA Forest Service (1982).

As the system grew in size, it became desirable to break the program into modules to facilitate construction and evaluation of the system. Each module would address a specific aspect of crowding. These issues, and the resulting modules, were: user perception, area management policy, management problems, trail damage, and campsite damage. A control module had to be developed that controlled which module (aspects of crowding) was to be considered in each situation. Rules were developed and incorporated into the system to move from the description of a particular crowding problem to a particular recommended solution. As an example, if the system user entered the system and indicated that crowding is a problem in a particular area, the system would ask whether the problem was seasonal or related to time, if there were other similar resources in the area, what the perceptions of the users were, what the Recreation Opportunity Spectrum (ROS) classification of the site was, and whether the manager wanted indirect or direct management policies. In this example, if the crowding happens at certain times or seasons, the crowding perception by the users is low, if it is not in the primitive classification of the ROS, if indirect management is the goal, and if the manager rates the problem as low to moderate, the expert system would recommend the manager try alternative indirect management approaches. These approaches would include: advertising underused areas, times and seasons; informing users of general patterns of use (so they could avoid high use seasons and times); or improving access roads or trails to others areas to spread the use.

The expert system developed in this project was first evaluated by a group of eight graduate students in recreation resource management who served as a pilot evaluation group. The system was then revised. Then it was used and evaluated by four outdoor recreation planners from local, state, and federal resource management agencies. Finally, this expert system was used and evaluated by twenty-four NPS employees including superintendents, rangers, managers, planners, and interpretive managers who attended the workshop that formed the basis for this publication.

Each participant in the system evaluation was placed at a personal computer which had been loaded with the expert system. An explanation of the system and a short summary of expert systems overall was given. A short demonstration or “walk through” of the system was conducted to introduce the participants to the system and how it was used. Each participant then had 30 minutes to enter the program using their own crowding scenario and problems, and to work through those problems to reach a set of recommendations on how to address crowding in their scenarios. At the conclusion of this 30-minute period of working with the system each participant completed an evaluative questionnaire about the effectiveness and efficiency of the system. It took about
30 minutes to complete the questionnaire. The authors of this report developed the evaluation questionnaire. The evaluation process followed that suggested by Tsai et al. (1992), incorporated many of the evaluation questions used by Adelman (1992), and centered on having the participants provide their views on the systems' strengths and weaknesses and how to improve them. The evaluation instrument included both quantitative and qualitative information. In addition to the questionnaire, the authors led a one-hour group discussion with the participants asking for their input on the strengths and weaknesses of this expert system. Their comments were noted and included in the overall evaluation of the system. Data from the questionnaire and the group evaluation discussion were analyzed and summarized to reach conclusions on the effectiveness and efficiency of this particular expert system.

Pros and Cons of Expert Systems in Recreation Resource Management

As a general evaluation of the expert system used in this project, the participants liked the system and many recognized it as having potential for helping management make decisions about crowding in national parks. Half the NPS employees in this study believed the system should be refined and installed in NPS field locations, 38 percent said they were unsure, and 8 percent said it should not be used. Most participants liked the system because it showed them a logical process of finding a solution to a crowding problem, and it provided an opportunity for learning about the variety of situations and solutions available within the system. However, most participants thought the system did not consider enough aspects of crowding, or in the manner in which they would like it to consider crowding. It also did not address issues in enough depth. The participants also wanted improvement in the actual use of the system to make it more user friendly. Most concluded it should not be installed at NPS locations without significant changes or expansion. A number of the participants said the system would be an effective training tool for students and new employees.

This expert system developed a number of limitations to address crowding in the national parks. Some of these limitations were technical in that the Level 5 programming language used proved to be difficult to program with the type of knowledge available on crowding. The program also proved to be less than ideal for the participants to use as they tried to navigate through the system to reach a set of recommendations for a particular problem. The other main limitation of this expert system was the difficulty in designing a logical system to address the very complex issue of crowding.

Level 5 language proved to be difficult to use in programming the system as the knowledge and variables in the system became more numerous and complex. One person worked to program this expert system, and as the system became more complex in its evolution it became more difficult for one person to accomplish all the programming necessary. In addition, the logic of the Level 5 language was not always obvious or intuitive. It was not possible for a system user to back up within a session because the variables the Level 5 uses were not
the ones the user saw on the screen. In addition, Level 5 is constrained to
variables of 60 characters or less and the English statements related to
the variables shown on the screen were often longer. This caused difficulty in
programming and in system use. We had used the Level 5 language in this
project because others had used it successfully to design expert systems at the
University of Minnesota. Considered in hindsight, it eventually just did not
seem to fit the issue or complexity of crowding as well as we had hoped.

The major limitation we found to developing an expert system to address
crowding in the national parks was a lack of available, agreed upon knowledge
by all experts about the impacts of crowding on recreation users and resources.
There is no one recognized expert on crowding issues. Many people
representing many different disciplines have studied the crowding phenomenon.
The one point of agreement shared by all these people is that crowding is a
complex phenomenon. No widely accepted process exists for deciding what
aspects of crowding are the most important, or which levels of impacts are the
most crucial. There is not generally agreed upon information on variations or
impacts of crowding in different environments. Even within one agency like the
NPS, there is no accepted expert on crowding, no comprehensive planning
document on crowding, or its variations or its impacts, or how to mitigate it.

In developing this expert system, we had various managers and experts review
its direction. They all added their own suggestions on crowding—they all
wanted to address crowding differently. Accommodating all the experts seemed
to result in the expert system becoming more general in scope than originally
planned. Accommodating all the experts also resulted in the various aspects of
crowding being considered independent of one another (i.e., trail overuse did not
affect campsite overuse). Much of the literature available on crowding
discusses individual impacts associated with crowding. But few studies relate
the various aspects of crowding to each other and to a general management
approach. The scope of the available knowledge on crowding (at least in
written form) is not complex and seems limited to specific impacts and specific
levels of impacts which are not necessarily widely supported. One of the major
conclusions of this attempt to design an expert system on crowding is that there
needs to be a significant amount of research conducted to determine the various
aspects and impacts of crowding and the most effective and efficient methods to
mitigate crowding and its impacts.

Computers and the State-of-the-art

At the time of this study, Level 5 and expert systems were “in vogue” and there
was a large amount of technical literature concerning artificial intelligence with
expert systems and neural networks. Expert systems were being created in a
variety of areas. These same trends can be seen in technical journals today.
Among others, current artificial intelligence journals include: IEEE Expert
(expert systems); IEEE Transactions on Neural Networks (neural networks);
and International Journal of Pattern Recognition and Artificial Intelligence
(neural networks). Yet the real world applications for these technologies seem
small. One can easily find a textual database search tool or an “intelligent”
program that monitors a machine (factory) process. Or, one can find an article on a particular expert system (or neural net) for a particular problem (Broggi and Berte 1995; Buro 1995; Lee et al. 1995). Expert systems are good for small structured problems; neural networks are good for pattern recognition (often optical); and data-based tools are often sophisticated keyword search engines. However, there really is not any broad-based artificially intelligent system that readily fits the problem of crowding in the national parks or any other outdoor recreation area.

**Conclusion**

We believe there are two important findings from this expert system development and evaluation project: (1) expert systems work best when addressing a problem with a known solution and (2) expert systems may not be the end result of a project. If an expert system is to be built to address a problem completely and to present a solution to the problem, then a complete understanding of the various aspects of a problem is required. This is just not the case presently with crowding. We neither have a clear understanding of the various aspects and impacts of the problem of crowding, nor do we know the solutions to particular crowding problems and their interrelationships. Because they are “rule based,” expert systems must be applied to problems that have complete solutions.

Since development of an expert system requires a complete understanding of the problem, then they may be a good tool for identifying the “state of the knowledge” of the problem area. Experts must agree on knowledge within the system because the computer is infallible in following the logic of that knowledge. Thus the future of expert systems in recreation management may be for use as small systems or for use as a tool for management to identify the scope of a problem area, including the processes and needs for implementing a solution. Examples of a small application of expert systems might be in automating a permit or reservation system, or to provide visitor information and guidance, or to determine the likely impacts of certain types of uses on certain types of natural environments. It may also be helpful to use a different expert system programming language other than Level 5, a system which has some general capabilities built in, such as file handling. One such programming language that may prove appropriate is PROLOG (Rauscher et al. 1990). But even this language has not made significant inroads toward expert system use. Lastly, the growth of the Internet and the World Wide Web may provide the best expert system. Rather than a “tool,” managers with questions or concerns about crowding and its impacts can quickly search the web for current information and names and addresses of other managers working on similar problems. As shown through most research, managers learn best and are more willing to try new strategies or management actions when they know other managers who have tried and been successful with them (Anderson and Morck 1986; Anderson et al. 1995).

This project also defines further questions about using computers in recreation resource management. Although the problems of recreation resource
management may be broad in scope, they may not be "logical." In other words, describing a set of logical steps for a solution to a problem for programming into a computer may be difficult because sequences do not exist or are difficult to discover, and the problems are not solved in a strictly logical, stepwise manner. After using this expert system one NPS employee in this evaluation study commented that he did not think logically and so did not like that aspect of the system. He said he thought artistically, which may imply he thinks relationally. There may be solutions to the recreation resource problems, but managers do not always think or follow a stepwise procedure or pattern in finding the solution. Perhaps a more loosely structured set of "suggestions" would be more appropriate for recreation resource managers rather than a set, complex expert system. Such a system might take the form of a sophisticated database query system where the user could ask relevant questions about crowding and be referred to a set of solutions found effective elsewhere, and also referred to a set of research results and experts to contact for deeper information. To our knowledge such a system does not exist regarding crowding. At the time of this project there was not even a computerized system within the NPS which gave relevant information in the form of keyword searching of a database of management literature.

Lastly, we had difficulty in using the available programming language to address an issue like crowding in an expert system. In the future, systems that use plain English language statements would be most useful (i.e., "summarize known literature on trail overuse problems for forested areas in the last 5 years"). However, programs like these would require a method for understanding English. Such programs are not yet practical or useful. Thus, using computers to offer solutions to the seemingly complex problems of recreation resource management may benefit from expert system use in small, easily definable situations, may benefit from using sophisticated database querying tools, or may need to wait until computer technology improves so more complex problems can be addressed.

Literature Cited


Potential of an Expert System
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