

Table of Contents

Keynote Address.....	1
Making research more relevant: Give it a try! <i>David W. Lime.....</i>	3
Crowding Issues in Resource Management.....	13
Balancing tradeoffs in the Denali Wilderness: An expanded approach to normative research using stated choice analysis. <i>Steven R. Lawson and Robert Manning.....</i>	15
Coping, crowding and satisfaction: A study of Adirondack wilderness hikers. <i>Andrew K. Johnson and Chad Dawson.....</i>	25
Perceived crowding at Boston Harbor Islands National Park Area. <i>Megha Budruk, Robert E. Manning, William A. Valliere, and Benjamin Wang.....</i>	32
Transportation planning and social carrying capacity in the National Parks. <i>William Valliere, Robert Manning, Megha Budruk, Steven Lawson, and Benjamin Wang.....</i>	36
The Role of Information in Travel Planning Decisions.....	41
Assessing information needs and communication behaviors of National Forest summer visitors. <i>James D. Absher, Brijesh Thapa, and Alan R. Graefe.....</i>	43
The commodification process of extreme sports: The diffusion of the X-Games by ESPN. <i>Chang Huh, Byoung Kwan Lee, and Euidong Yoo.....</i>	49
Marketing National Parks: Oxymoron or opportunity? <i>Alan K. Hogenauer.....</i>	53
Demographic Trends in Outdoor Recreation Participation & Travel.....	61
Wildlife-associated recreation in the North Central Region: Participation patterns and management implications. <i>Allan Marsinko and John Dwyer.....</i>	63
The New England travel market: Generational travel patterns, 1979 to 1996. <i>Rod Warnick.....</i>	69
Welcome center research: How valuable is secondary research? <i>Lousia Meyer, Tara Patterson, Lori Pennington-Gray, Andrew Holdnak, and Brijesh Thapa.....</i>	76
Methodology in Outdoor Recreation Research I: Interventions.....	79
Unique programming: An examination of the benefits of a free choice program. <i>Dorothy L. Schmalz, Deborah L. Kerstetter, and Harry C. Zinn.....</i>	81
Outdoor experiential-based training: Motivational and environmental influences affecting outcomes. <i>Teresa (Birdie) High and Alan R. Graefe.....</i>	85
Use of experience sampling method to understand the wilderness experience. <i>Lynn Anderson.....</i>	92
Encounters and the guided group trip: Going "on-the-scene" to examine the situational interpretation of encounters. <i>Erin K. Sharpe.....</i>	98

Leisure Motivations of Outdoor Recreationists.....	105
Differences in SCUBA diver motivations based on level of development. <i>Sharon L. Todd, Alan R. Graefe, and Walter Mann.....</i>	107
Skier motivations: Do they change over time? <i>Erin White and Lori Pennington-Gray.....</i>	115
Sociocultural perspectives of trapping revisited: A comparative analysis of activities and motives 1994 and 2000. <i>Rodney R. Zwick, Ron Glass, Kim Royar, and Tom Decker.....</i>	118
Resource Management & International Tourism Development.....	125
The impact of potential political security level on international tourism. <i>Young-Rae Kim, Chang Huh, and Seung Hyun Kim.....</i>	127
Future of the Korea National Parks: A preliminary Delphi study of key experts. <i>Byung-kyu Lee and Wilbur F. LaPage.....</i>	130
User Satisfaction in Outdoor Recreation.....	133
A preliminary analysis of Florida State Park satisfaction survey data. <i>Andrew Holdnak, Stephen Holland, and Erin Parks.....</i>	135
Recreationists in the Columbia River Gorge National Scenic Area: A survey of user characteristics, behaviors, and attitudes. <i>Robert C. Burns and Alan R. Graefe.....</i>	138
Visitor satisfactions: Backcountry and wilderness users in the White Mountain National Forest. <i>Chad P. Dawson, Rebecca Oreskes, Frederick Kacprzyński, and Tom More.....</i>	144
Participants' perceptions of the 1997-1998 Missouri State Parks Passport Program. <i>Yi-Jin Ye and Jaclyn Card.....</i>	153
Environmental Knowledge, Concern, Behavior & Education.....	161
An evaluation of Appalachian Trail hikers' knowledge of minimum impact skills and practices. <i>Peter Newman, Robert Manning, Jim Bacon, Alan Graefe, and Gerard Kyle.....</i>	163
Who cares and who acts? Different types of outdoor recreationists exhibit different levels of environmental concern and behavior. <i>Mario F. Teisl and Kelly O'Brien.....</i>	168
Visitor behavior and resource impacts at Cadillac Mountain, Acadia National Park. <i>Rex Turner and Wilbur LaPage.....</i>	175
Leisure Constraints of Outdoor Recreationists.....	181
The effects of perceived leisure constraints among Korean university students. <i>Sae-Sook Oh, Sei-Yi Oh, and Linda L. Caldwell.....</i>	183
Exploration of the influence of self-efficacy on recreation participation levels of individuals with visual impairments who use dog guides. <i>Laurlyn K. Harmon and Linda L. Caldwell.....</i>	188
Urban Recreation & Development Issues.....	193
An integrative concept for visitor monitoring in a heavily used conservation area in the vicinity of a large city: The Danube Floodplains National Park, Vienna. <i>Arne Arnberger, Christiane Brandenburg, and Andreas Muhar.....</i>	195

Linkages in the use of recreation environments across the urban to ex-urban spectrum by urban residents. <i>John F. Dwyer and Susan C. Barro</i>	202
The role, use and benefits of natural recreation areas within and near residential subdivisions. <i>Christine A. Vogt and Robert W. Marans</i>	208
Economic Impacts & Non-economic Benefits of Tourism	215
New York State's 1999 agritourism business study. <i>Diane Kuehn and Duncan Hilchey</i>	217
Rail-trails and special events: Community and economic benefits. <i>Charles Nelson, Christine Vogt, Joel Lynch, and Daniel Stynes</i>	220
Private business perceptions of transportation issues and the Island Explorer Bus system at Acadia National Park, Maine. <i>Rea Brennan, Marc Edwards, and John J. Daigle</i>	225
Management Decision-making & Planning for Outdoor Recreation	231
Integrating resource, social and managerial indicators of quality into carrying capacity decision making. <i>Peter Newman, Robert Manning, and Bill Valliere</i>	233
Redefining roles of science in planning and management: Ecology as a planning and management tool. <i>Greg Mason and Stephen Murphy</i>	239
Impacts of Wildlife Viewing	247
Elk viewing in Pennsylvania: An evolving eco-tourism system. <i>Bruce E. Lord, Charles H. Strauss, and Michael J. Powell</i>	249
Competing values: A case study of Pennsylvania's elk herd as a tourism attraction. <i>Jeffrey A. Walsh and Leonard K. Long</i>	253
Impacts of wildlife viewing at Dixville Notch Wildlife Viewing Area. <i>Judith K. Silverberg, Peter J. Pekins, and Robert A. Robertson</i>	260
Methodology in Outdoor Recreation Research II: Instruments & Methods	267
Effects of pretesting with the adventure recreation model instrument. <i>Anderson Young, Lynn Anderson, and Dale Anderson</i>	269
Modeling nonlinear preferences. <i>Donald F. Dennis</i>	275
Personal Relevance, Involvement & Loyalty in Outdoor Recreation	279
Psychological commitment as a mediator of the relationship between involvement and loyalty. <i>Joohyun Lee and Alan Graefe</i>	281
Gender Issues in Outdoor Recreation & Resource Management	289
Older Chinese women immigrants and their leisure experiences: Before and after emigration to the United States. <i>Ching-Hua Ho and Jaclyn A. Card</i>	291
Towards an understanding of gender differences with respect to whitewater rafting preferences. <i>Duarte B. Morais, Traci Zillifro, and Susanne Dubrouillet</i>	298

Trails over Land & Water: Issues of Multiple Use & Conflict	305
Use and user patterns among Michigan licensed Off-Highway Vehicles ownership types. <i>Joel A. Lynch and Charles M. Nelson</i>	307
Recreation conflict of riparian landowners with personal watercraft and motorboat use along the New York's Great Lakes. <i>Cheng-Ping Wang and Chad P. Dawson</i>	314
User preferences for social conditions on the St. Croix International Waterway. <i>Jamie Hannon, John J. Daigle, and Cynthia Stacey</i>	320
Security along the Appalachian Trail. <i>James J. Bacon, Robert E. Manning, Alan R. Graefe, Gerard Kyle, Robert D. Lee, Robert C. Burns, Rita Hennessy, and Robert Gray</i>	326
Trails research: Where do we go from here? <i>Michael A. Schuett and Patricia Seiser</i>	333
Attachments to Places & Activities in Outdoor Recreation	337
Visitor meanings of place: Using computer content analysis to examine visitor meanings at three National Capitol sites. <i>Wei-Li Jasmine Chen, Chad L. Pierskalla, Theresa L. Goldman, and David L. Larsen</i>	339
The importance of visitors' knowledge of the cultural and natural history of the Adirondacks in influencing sense of place in the High Peaks Region. <i>Laura Fredrickson</i>	346
Attachments to places and activities: The relationship of psychological constructs to customer satisfaction attributes. <i>Thomas D. Wickham and Alan R. Graefe</i>	356
An exploration of human territoriality in forest recreation. <i>Harry C. Zinn, Laurlyn K. Harmon, Brijesh Thapa, Deborah L. Kerstetter, and Alan R. Graefe</i>	365
Community attachment and resource harvesting in rural Denmark. <i>Rodney R. Zwick and David Solan</i>	369
Poster Session	375
The political economy of wilderness designation in Nova Scotia. <i>Glyn Bissix, Leah Levac, and Peter Horvath</i>	377
The Westfield River Watershed Interactive Atlas: Mapping recreation data on the Web. <i>Robert S. Bristow and Steven Riberdy</i>	383
Park resources as an essential to urban societies. <i>Kristin Dion, Doug Stefancik, Serena Hawkins, and Robert Bristow</i>	386
Parks and recreation employment status: Implications from a civil service perspective. <i>Joel Frater and Arthur Graham</i>	390
Natural resources interpretation: The role of researchers – A new-old approach. <i>Mark Gleason</i>	395
Mountain bike trail compaction relation to selected physical parameters. <i>Jeff Hale and Rodney R. Zwick</i>	399
Internet & branding: A perfect match or a fatal attraction? Analysis of fifty states of the U.S. official tourism websites. <i>Gyehee Lee, Liping A. Cai, Everette Mills, and Joseph T. O'Leary</i>	403

Job satisfaction among recreation practitioners. <i>Erin Parks and Andrew Holdnak</i>	411
Extensivity and intensity of grants usage in obtaining funding for recreation services and capital improvement projects among park and recreation agencies in the state of Michigan. <i>Jerry L. Ricciardo</i>	415
Resident camp directors, spirituality, and wilderness. <i>Michael Rule and Edward Udd</i>	418
Social groups preferences relation to motivations and ability levels of whitewater kayakers. <i>Seth Turner and Rod Zwick</i>	421
Management Presentation	427
Human preferences for ecological units: Patterns of dispersed campsites within landtype associations on the Chippewa National Forest. <i>Lisa Whitcomb, Dennis Parker, Bob Carr, Paul Gobster, and Herb Schroeder</i>	429
Roundtable Discussions	435
Creating recreation partnerships on private agricultural and forest land in the urban Northeast: A case study from the Great Meadows of the Connecticut River. <i>Robert L. Ryan and Juliet Hansel</i>	437
Applied research opportunities in developed campgrounds. <i>Carl P. Wiedemann</i>	443
Adapting the Recreation Opportunity Spectrum (ROS) for states lands planning. <i>Susan Bulmer, Linda Henzel, Ann Mates, Matt Moore, and Thomas A. More</i>	447
It's time to put the C.A.R.T. before the H.O.R.S.E. or Putting Critical, Analytical, and Reflective Thinking before "Handyman" Oriented Recreation Student Education. <i>David L. Jewell</i>	452
Index of Authors	457

Crowding Issues in Resource Management

BALANCING TRADEOFFS IN THE DENALI WILDERNESS: AN EXPANDED APPROACH TO NORMATIVE RESEARCH USING STATED CHOICE ANALYSIS

Steven R. Lawson

Graduate Research Assistant, School of Natural Resources,
University of Vermont, Burlington, VT 05405

Robert Manning

Professor, School of Natural Resources, University of
Vermont, Burlington, VT 05405

Abstract: Wilderness experiences are thought to be comprised of or defined by three dimensions, including social, resource, and management conditions. Decisions about how to manage wilderness recreation in Denali National Park involve potential tradeoffs among the conditions of resource, social, and managerial attributes of the wilderness experience. This study expands the normative approach to wilderness research by developing a decision-making model that considers social, resource, and managerial attributes of the wilderness experience within a holistic context. Specifically, stated choice analysis is used to evaluate the choices overnight wilderness visitors in Denali National Park make when faced with hypothetical tradeoffs among the conditions of social, resource, and management attributes of the wilderness portion of the park.

Introduction

There is general agreement in the recreation literature that wilderness experiences are comprised of or defined by three dimensions. These dimensions include the social conditions experienced (e.g., the number of other groups encountered), the resource conditions experienced (e.g., the amount of human impact at camping sites), and the management conditions imposed (e.g., the number of backcountry permits issued) (Hendee, Stankey, & Lucas, 1990). In general, wilderness recreationists are thought to prefer a wilderness experience characterized as having few encounters with other groups, a pristine natural environment, and a high degree of freedom from management control. While this is the ideal, in reality attempts on the part of managers to provide ideal conditions along one dimension of the wilderness experience typically involve having to make concessions along one or both of the other dimensions of the wilderness experience. As a result, decisions about how to manage wilderness involve potential tradeoffs among the conditions of resource, social, and managerial attributes of the wilderness experience. For example, the number of permits issued for recreational use of a wilderness area could be increased to allow more public access, but this might result in more resource impacts and encounters among groups within the wilderness area. Conversely, reducing the number of recreational use permits issued might reduce resource impacts and encounters among groups, but would allow fewer people to enjoy the wilderness area.

The normative approach to recreation research has been used to study a broad range of wilderness management issues, including crowding, ecological impacts, and management practices (Manning, 1999a). A fundamental element of the normative approach to recreation research is the measurement of indicators and standards of quality. Traditionally, wilderness studies designed to measure indicators and standards of quality have focused on a single dimension of the wilderness experience, without explicit consideration of related and potentially competing issues associated with other dimensions of the wilderness experience (Manning, 1999a). Recent studies in outdoor recreation have suggested that normative research should more explicitly consider the tradeoffs inherent in park and wilderness management decision-making (Hall, in press; Lawson & Manning, 2000; Manning, Valliere, Wang, & Jacobi, 1999).

This study expands the normative approach to wilderness research by developing a decision-making model that considers social, resource, and managerial attributes of the wilderness experience within a more holistic context. Specifically, stated choice analysis is used to evaluate the choices overnight wilderness visitors in Denali National Park make when faced with hypothetical tradeoffs among the conditions of social, resource, and management attributes of the wilderness portion of the park.

Denali National Park and Preserve

Alaska's first National Park, Mt. McKinley National Park, was established in 1917. In 1980, with the passage of the Alaska National Interest Lands Conservation Act, Mt. McKinley National Park was expanded from two million acres to six million acres, and renamed Denali National Park and Preserve. At the same time, most of the original two million acres of the park was designated wilderness. Today, this two million acre wilderness forms the core of Denali National Park and Preserve.

Visitor use of the Denali wilderness is managed through a permit system to maintain the area's primitive, undeveloped character. Through the permit system, the Park administers strict quotas on the number of overnight visitors issued a permit for each of 43 wilderness management units. The quotas exist to prevent resource degradation and to provide visitors with opportunities to experience solitude. During the busy summer months, quotas for many of the management units are regularly reached and some visitors interested in an overnight trip in the Denali wilderness are turned away or forced to hike and camp in less preferred management units.

The primitive character of Denali's wilderness is maintained through other management techniques as well. For example, traditional backcountry facilities such as bridges and trails are not provided in the Denali wilderness. Instead, visitors must navigate by map and compass, and visitors are frequently challenged with technical stream-crossings. There are no established campsites in the Denali wilderness, either. Visitors may camp anywhere within the management unit for which they were issued an overnight permit. As a result, visitors are often able to camp out of

sight and sound of other groups, in places with little or no evidence of previous human use.

Park managers and planners are currently working on updating the wilderness management plan for Denali National Park and Preserve. Revision of the wilderness management plan will include making decisions to maintain, reduce, or decrease the number of permits issued for each of the Denali wilderness management units. Previous research conducted by Bultena, Albrecht, and Womble (1981) studied the extent to which wilderness visitors in Denali National Park and Preserve supported use limitations. The authors conclude that future decisions concerning use limitations in Denali National Park and Preserve will have to weigh the importance of protecting park resources and the quality of visitors' experiences against the benefit of granting more visitors access to the Denali wilderness. This study uses stated choice analysis to provide Denali National Park and Preserve managers with information about overnight wilderness visitors' attitudes and preferences regarding such tradeoffs.

Stated Choice Analysis

Stated choice analysis models have been developed in the fields of psychometrics, econometrics, and consumer marketing to evaluate public preferences or attitudes (Green & Srinivasan, 1978). In stated choice analysis, respondents are asked to make choices among alternative configurations of a multi-attribute good (Louviere & Timmermans, 1990a).¹ Each alternative configuration is called a profile, and is defined by varying levels of selected attributes of the good (Mackenzie, 1993). For example, respondents may be asked to choose between alternative recreation settings that vary in the number of other groups encountered, the quality of the natural environment, and the intensity of management regulations imposed on visitors. Respondents' choices among the alternatives are evaluated to estimate the relative importance of each attribute to the overall utility derived from the recreational setting. Further, stated choice analysis models are used to estimate public preferences or support for alternative combinations of the attribute levels (Dennis, 1998).²

Stated choice analysis has been applied to study public preferences and attitudes concerning a range of recreation-related issues. Louviere and Timmermans (1990a) suggest ways in which stated choice models can be used to evaluate alternative recreation policies. Specifically, the authors state that one of the strengths of choice models is their predictive ability. That is, choice models provide recreation managers with foresight about how the public is likely to respond to various policy alternatives. Further, choice models provide managers with information about people's preferences for arrangements of resources, facilities, and/or services that may not currently exist.

There is a growing body of literature describing the application of stated choice analysis to outdoor recreation management issues in parks (Louviere & Timmermans, 1990b; Louviere & Woodworth, 1985; Schroeder, Dwyer, Louviere, & Anderson, 1990). Other natural resource

related applications of stated choice analysis include studies of river flow management (Adamowicz, Louviere, & Williams, 1994), tourism (Haider & Ewing, 1990), recreational hunting (Boxall, Adamowicz, Swait, Williams, & Louviere, 1996; Bullock, Elston, & Chalmers, 1998; Mackenzie, 1993), hazardous waste facility siting (Opaluch, Swallow, Weaver, Wessells, & Wichelns, 1993; Swallow, Weaver, Opaluch, & Michelman, 1994), watershed management (Johnston, Swallow, & Weaver, 1999), and wildlife management (Adamowicz, Boxall, Williams, & Louviere, 1998).

Study Methods

Selection of Attributes and Levels

Wilderness areas are managed, in general, to provide visitors with opportunities to experience solitude in a relatively unmodified natural environment with few management restrictions and facilities (Merigliano, 1990). Substantial research has been conducted to identify social, resource, and managerial setting attributes that reflect these general management objectives and contribute to or detract from the quality of the wilderness recreation experience (Merigliano, 1990; Roggenbuck, Williams, & Watson, 1993; Shindler & Shelby, 1992; Whittaker, 1992). These attributes are commonly referred to in the recreation literature as indicators of quality.

Manning (1999b) summarizes the results of a number of studies that have focused on identifying potential indicators of quality. Based on a review of this literature, six wilderness setting attributes were selected for this study to define the social, resource, and management conditions of the Denali wilderness setting profiles. Three levels were defined for each of the six wilderness setting attributes, based on recommendations from the Park's director of Resource Management and the Park's Planner. Table 1 lists the attributes and levels used to define alternative Denali wilderness settings in the study.

Pairs of hypothetical Denali backcountry settings were generated by combining the six wilderness setting attributes at varying levels, based on an experimental design. The experimental design resulted in four questionnaire versions, each containing nine pairwise comparisons (Seiden, 1954).³ An example of a typical Denali wilderness setting comparison is presented in Figure 1.

Survey Administration

Overnight wilderness visitors in Denali National Park and Preserve are required to obtain a permit and a bear resistant food container from the Visitor Center prior to their backpacking trip. The stated choice analysis survey was administered to overnight wilderness visitors at the Visitor Center when they returned the bear resistant food container at the end of their backpacking trip. The survey was administered from July 24 through September 2, 2000. The choice experiment was conducted as part of a larger study of Denali overnight wilderness visitors. Individuals who did not participate in other parts of the larger study were

Table 1. Denali Wilderness Setting Attributes and Levels

<p><u>Social conditions</u></p> <p>Number of other groups encountered per day while hiking: Encounter 0 other groups per day while hiking Encounter up to 2 other groups per day while hiking Encounter up to 4 other groups per day while hiking</p> <p>Opportunity to camp out of sight and sound of other groups: Able to camp out of sight and sound of other groups all nights Able to camp out of sight and sound of other groups most nights Able to camp out of sight and sound of other groups a minority of nights</p> <p><u>Resource conditions</u></p> <p>Extent and character of hiking trails: Hiking is along intermittent, animal like trails Hiking is along continuous single track trails developed from prior human use Hiking is along continuous trails with multiple tracks developed from prior human use</p> <p>Signs of human use at camping sites: Camping sites have little or no signs of human use Camping sites have some signs of human use – light vegetation damage, a few moved rocks Camping sites have extensive signs of human use – bare soil, many rocks moved for wind protection and cooking</p> <p><u>Management conditions</u></p> <p>Regulation of camping: Allowed to camp in any zone on any night Required to camp in specified zones Required to camp in designated sites</p> <p>Chance of receiving an overnight backcountry permit: Most visitors are able to get a permit for their preferred trip Most visitors are able to get a permit for at least their second choice trip Only a minority of visitors are able to get a backcountry permit</p>
--

Backcountry Setting A
<ul style="list-style-type: none"> • Encounter up to 2 other groups per day while hiking. • Able to camp out of sight and sound of other groups <i>all</i> nights. • Hiking is along continuous, <i>single track</i> trails developed from prior human use. • Camping sites have <i>some</i> signs of human use – light vegetation damage, a few moved rocks. • Required to camp at <i>designated sites</i>. • Only a minority of visitors are able to get a backcountry permit.

Backcountry Setting B
<ul style="list-style-type: none"> • Encounter up to 4 other groups per day while hiking. • Able to camp out of sight and sound of other groups <i>most</i> nights. • Hiking is along intermittent, animal-like trails. • Camping sites have <i>some</i> signs of human use – light vegetation damage, a few moved rocks. • Required to camp at <i>designated sites</i>. • Most visitors are able to get a backcountry permit for their <i>preferred</i> trip.

Figure 1. Example Denali Wilderness Setting Comparison

recruited for the stated choice experiment. Study participants were asked to complete one of four versions of the questionnaire on a laptop computer. In each of the nine choice questions, respondents were asked to read through each setting description (A and B) and indicate which they preferred. The response rate for the stated choice analysis survey was 81.2%, resulting in a total of 311 completed questionnaires (approximately 78 respondents for each version of the questionnaire) and 2,799 pairwise comparisons.

Study Findings

The responses to the stated choice questions were analyzed using logistic regression analysis.⁴ The regression coefficients for the Denali wilderness setting attributes, together with their standard errors, Wald Chi-Square values, and P values are presented in Table 2. All coefficients are significantly different than zero at <.001% level, except the coefficients on "Up to 2 other groups" and "Intermittent animal like trails". The overall fit of the model is supported by the results of the Hosmer and Lemeshow goodness of fit test ($\chi^2 = 3.492$, $p = 0.836$).

The magnitude of significant coefficients reflects the relative importance of the corresponding level of the attribute to Denali overnight wilderness visitors. The values of the coefficients in Table 2 imply that signs of human use at campsites influence Denali overnight wilderness visitors' utility or satisfaction more than any other wilderness setting attribute considered in this study. Specifically, camping site conditions characterized as having "Extensive signs of human use" are evaluated less favorably by Denali overnight wilderness visitors' than any other level of the six wilderness setting attributes studied. Additionally, camping site conditions characterized by "Little or no signs of human use" are preferred more than any level of any other wilderness setting attribute included in the study.

The magnitude of the coefficient estimates in Table 2 indicate that solitude related attributes represent a second tier of importance to Denali overnight wilderness visitors. That is, while the number of encounters with other groups per day while hiking and opportunities to camp out of sight and sound of other groups are less important wilderness setting attributes relative to campsite impacts, they demonstrate a relatively large influence on Denali overnight wilderness visitors' utility. The extent and character of trails, regulations concerning where visitors are allowed to camp in the Denali wilderness, and the availability of backcountry permits are less important to Denali overnight wilderness visitors, relative to campsite impacts and solitude related attributes of the Denali wilderness.

The relationship between the levels of each wilderness setting attribute and the average utility associated with all possible combinations of the six Denali wilderness setting attributes are plotted in Figures 2a-2f. The values on the x-axis of each plot represent the level of the corresponding Denali wilderness setting attribute, and the values on the y-

axis represent the amount by which the utility of the corresponding level of the attribute deviates from average utility or satisfaction. The values on the y-axis are expressed in units of utility, which is a measure of relative preference. Levels of attributes with high utility values are preferred to levels of attributes with lower utility values. The plots provide further insight into the relative importance of the wilderness setting attributes to Denali overnight wilderness visitors. For example, utility drops sharply as campsites change from having "Some signs of human use" (+0.2073) to "Extensive signs of human use" (-0.7896) (Figure 2d), whereas the loss of utility is less dramatic as the opportunity to camp out of sight and sound of other groups changes from "All nights" (0.2952) to "Most nights" (0.1452) (Figure 2b).⁵

The results of the stated choice experiment suggest that Denali overnight wilderness visitors support some level of management over where visitors may camp and a certain degree of visitor use limits. Denali overnight wilderness visitors' utility remains unchanged as regulations over where visitors may camp increases from "Allowed to camp in any zone on any night" to "Required to camp in specified zones" (Figure 2e). However, utility decreases to its lowest point with respect to camping regulations when visitors are "Required to camp in designated sites". A similar trend is observed concerning overnight wilderness use limits. Denali overnight wilderness visitors' utility associated with this attribute is statistically the same whether use limits are at their least restrictive level (i.e., "Most get a permit for their preferred trip") or at the intermediate level (i.e., "Most get a permit for at least their second choice trip") (Figure 2e). Use limits that result in only a minority of visitors receiving a permit lead to the lowest utility related to use limits (i.e., the chance visitors have of receiving a permit). A possible explanation for these results is that Denali overnight wilderness visitors may realize that without certain management restrictions, the resource and social setting attributes of the Denali wilderness are likely to deteriorate beyond acceptable conditions.

An additional use of the model developed in this study is to predict the preferences of Denali overnight wilderness visitors for alternative wilderness management scenarios. As an example, two hypothetical Denali wilderness management alternatives will be considered. The first alternative will be referred to as the "Solitude Alternative" and the second alternative will be referred to as the "Freedom Alternative" (Table 3). Under the "Solitude Alternative", overnight wilderness visitors would encounter zero other groups per day while hiking and be able to camp out of sight and sound of other groups all nights. However, the two management attributes would be at their most restrictive levels. That is, visitors would be required to camp in designated sites and only a minority of visitors would be able to get a backcountry permit. Under the "Freedom Alternative", overnight wilderness visitors would be able to camp in any zone on any night, and most visitors would be able to get a permit for their preferred trip. However, visitors would encounter up to four other groups

Table 2. Coefficient Estimates for Wilderness Setting Attributes

Variable	Coefficient	Standard Error	Wald Chi-Square	P Value
Encounters with other groups per day while hiking:				
0 other groups	-	-	-	-
Up to 2 other groups	0.0649	0.0433	2.2458	0.1340
Up to 4 other groups	-0.5044	0.0438	132.8263	0.0001
Able to camp out of sight and sound of other groups:				
All nights	-	-	-	-
Most nights	0.1452	0.0435	11.1482	0.0008
A minority of nights	-0.4404	0.0452	94.8138	0.0001
Hiking is along:				
Intermittent, animal like trails	-	-	-	-
Single track trails developed from human use	-0.0281	0.0443	0.4028	0.5256
Multiple track trails developed from human use	-0.2912	0.0428	46.3399	0.0001
Camping sites have:				
Little or no signs of human use	-	-	-	-
Some signs of human use	0.2073	0.0440	22.1506	0.0001
Extensive signs of human use	-0.7896	0.0485	264.9717	0.0001
Regulation of camping:				
Allowed to camp in any zone on any night	-	-	-	-
Required to camp in specified zones	0.1398	0.0476	8.6202	0.0033
Required to camp in designated sites	-0.2117	0.0452	21.9484	0.0001
Chance visitors have of receiving a permit:				
Most get a permit for their preferred trip	-	-	-	-
Most get a permit for at least their second choice	0.1430	0.0443	10.4236	0.0012
Only a minority get a permit	-0.2157	0.0434	24.6555	0.0001

Figures 2a-2f. Denali Wilderness Setting Attribute Levels and Corresponding Utility

Figure 2a. Hiking Encounters per Day

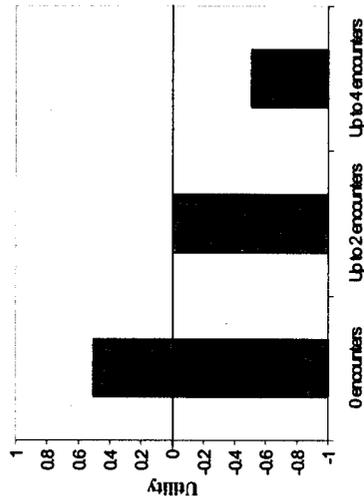


Figure 2b. Able to Camp Out of Sight and Sound of Others

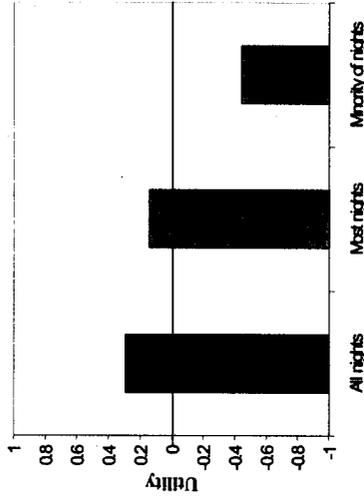


Figure 2c. Extent and Character of Trails

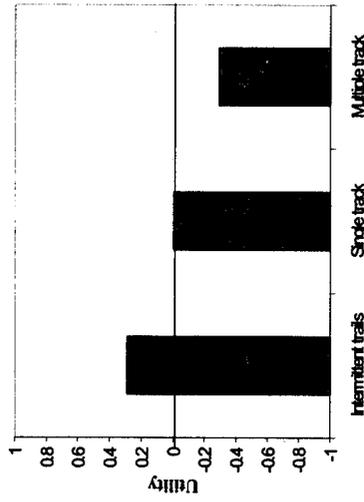


Figure 2d. Extent of Impact at Campsites

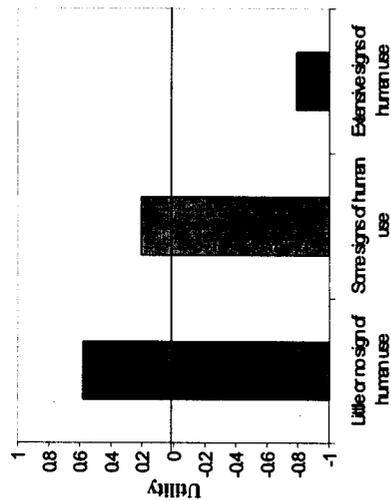


Figure 2e. Camping Regulations

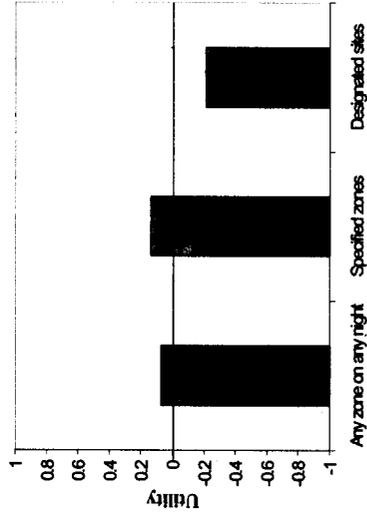
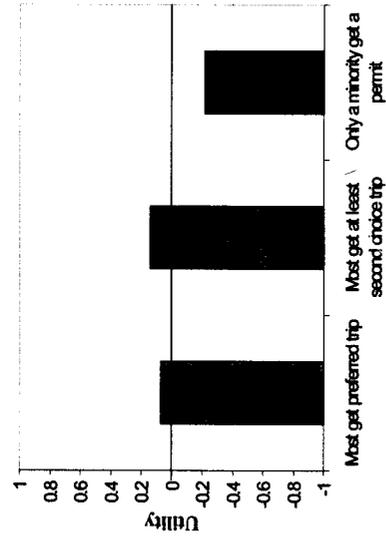


Figure 2f. Availability of Backcountry Permits



per day while hiking, and they would be able to camp out of sight and sound of other groups only a minority of nights. In both alternatives, the extent of social trails, and the amount of impact to campsites would be fixed at the intermediate level.

At the heart of the comparison between the "Solitude Alternative" and the "Freedom Alternative" are Denali overnight wilderness visitors' evaluations of the tradeoff

between freedom of access to the Denali wilderness and the opportunity to experience solitude. The model predicts that in a hypothetical referendum, 75% of Denali overnight wilderness visitors would choose the "Solitude Alternative" and only 25% would choose the "Freedom Alternative" (Table 3).⁶ This result implies that in general, Denali overnight wilderness visitors would prefer to forgo some freedom from management to improve opportunities to experience solitude.

Table 3. Scores for Two Hypothetical Denali Wilderness Management Alternatives

	Solitude Alternative	Freedom Alternative
Hiking Encounters:	0 other groups per day	Up to 4 other groups per day
Campsite Solitude:	All nights	A minority of nights
Hiking Trails:	Single track trails	Single track trails
Campsite Impacts:	Some signs of human use	Some signs of human use
Camping Regulations:	Designated sites	Any zone on any night
Availability of permits:	Only a minority of visitors receive a permit	Most get a permit for their preferred trip
Voting Proportion	75%	25%

Conclusions

In this study, stated choice analysis has been used to expand the normative approach to wilderness research by explicitly considering tradeoffs among the social, resource, and managerial dimensions of the Denali wilderness experience in the measurement of indicators and standards of quality. The results of the stated choice analysis presented in this paper have several important implications for wilderness management in Denali National Park and Preserve.

Consistent with the findings of previous wilderness research, Denali overnight wilderness visitors place particular importance on the extent of impacts at camping sites (Roggenbuck, Williams, & Watson, 1993). Management actions that provide Denali overnight wilderness visitors with places to camp that have no more than some signs of human use will make substantial positive contributions to the quality of their wilderness experiences. Camping conditions characterized by sites with extensive signs of human use greatly detract from the quality of visitors' wilderness experience in Denali. Further, Denali overnight visitors place relatively high importance on having limited contact with other groups while hiking and camping.

Several aspects of the study findings suggest that visitors would be willing to tolerate, and in fact support, management restrictions, including use limits, to achieve

desired social and resource setting attribute conditions. For example, the results suggest that Denali overnight wilderness visitors are indifferent between the current regulation in Denali National Park and Preserve which requires visitors to camp in specified zones and being allowed to camp in any zone on any night. Additionally, the results suggest that visitors' utility does not diminish if limits on the number of backcountry permits issued are increased from the least restrictive level considered in this study to the intermediate level, even though their chances of receiving a permit for their preferred trip would be reduced. As noted above, a possible explanation for these findings is that Denali overnight wilderness visitors might consider a certain degree of management regulations necessary to achieve desirable social and resource conditions in the Denali wilderness.

On a more general level, the model allows managers to evaluate visitor attitudes toward alternative management scenarios. This allows managers to consider combinations of setting attributes that are not currently in place, but may offer a better alternative than the status quo. Additionally, alternatives being considered under the new wilderness management plan can be generalized to the model, and managers can predict public response to each alternative. The results of the example application of the choice model provide further evidence that visitors are willing to trade off freedom from management restrictions for desired social conditions. Specifically, the results demonstrate that in a hypothetical referendum, Denali overnight wilderness visitors would prefer a wilderness setting that emphasizes

solitude through relatively restrictive management actions over a more congested wilderness setting with limited management restrictions by a margin of three to one.

From a management perspective, these results suggest that the majority of Denali overnight wilderness visitors support backcountry permit quotas in Denali National Park and Preserve to protect the primitive character of the park. A moderately restrictive quota system that is designed to enhance overnight wilderness visitors' opportunities to experience solitude and to maintain relatively undisturbed campsite and trail conditions will receive the greatest support from Denali overnight wilderness visitors. However, the results of the example application of the choice model indicate that there is also a substantial proportion of Denali overnight wilderness visitors (25.0%) that place high importance on freedom from management restrictions despite reduced opportunities to experience limited contact with other groups while hiking and camping. This finding suggests that Denali overnight visitors are at least somewhat diverse in their attitudes concerning the management of the Denali wilderness. Managers at the park could address this diversity through management of the Denali wilderness based on the concept of zoning to provide a spectrum of opportunities for visitors. For example, the quota system could be designed in such a way that quotas for most zones within the Denali wilderness are set at levels that emphasize opportunities for visitors to experience solitude, while quotas for a few zones of the wilderness are set at levels that provide greater visitor access.

The results of this study indicate that certain conditions of each of the six Denali wilderness setting attributes provide a greater than average level of utility to Denali overnight wilderness visitors. However, Figures 2a-2f illustrate that when the conditions of the Denali wilderness setting attributes deteriorate beyond "threshold" levels, they provide less than average levels of utility (e.g., when camping sites deteriorate from having some signs of human use to extensive signs of human use). These findings imply that the wilderness experience in Denali National Park and Preserve can be substantially improved by restoring the social and resource conditions of the wilderness from beyond "threshold" levels. Likewise, the wilderness experience can be protected from substantial decline by keeping wilderness setting conditions from deteriorating beyond "threshold" levels.

The threshold levels for each of the six Denali wilderness setting attributes, illustrated in Figures 2a-2f, could be used by park managers to help formulate standards of quality. For example, Figure 2a demonstrates that fewer than two encounters with other groups per day while hiking provides a greater than average level of utility to Denali overnight visitors and that encounters with more than two other groups per day while hiking provides a less than average level of utility. Therefore, a potential standard of quality for this attribute might be set at "up to 2 encounters with other groups per day while hiking". The use of stated choice analysis data to help formulate standards of quality for wilderness setting conditions represents a potential improvement to the conventional normative approach in

recreation research, in that resulting data reflect the tradeoffs visitors are willing to make among the conditions of social, resource, and managerial attributes of the Denali wilderness.

A potential limitation of this study is that the relative importance of the Denali wilderness setting attributes considered are influenced by the levels of the attributes selected. Our findings may have varied if we had used different levels to represent the range of conditions for each attribute. For example, we may have found the relative importance Denali overnight wilderness visitors place on the chance of receiving an overnight backcountry permit to be greater if we had used "Visitors have a 5% chance of receiving a backcountry permit" rather than "Only a minority of visitors are able to get a backcountry permit". However, the levels of the Denali wilderness setting attributes were selected to represent a realistic range of conditions for each of the Denali wilderness setting attributes, based on current conditions in the Park. As a result, it seems reasonable to conclude that the results of this study realistically represent Denali overnight wilderness visitors' attitudes and preferences concerning the conditions of social, resource, and managerial attributes of the Denali wilderness experience.

Previous recreation research indicates that attitudes and preferences concerning indicators of quality may be influenced by personal characteristics of visitors, such as the level of experience an individual has (Bryan, 1977; Ditton, Fedler, & Graefe, 1983; Graefe, Donnelly, & Vaske, 1986; Munley & Smith, 1976). Further research could be conducted to examine differences in the way novice and experienced Denali overnight wilderness visitors evaluate tradeoffs among the conditions of social, resource, and managerial attributes of the Denali wilderness. This information would provide managers with a better understanding of the preferences of different types of overnight wilderness visitors and could be used to identify wilderness setting conditions that are most suitable for different types of overnight wilderness visitors.

The findings of this study reflect the attitudes and preferences of overnight wilderness visitors in Denali National Park and Preserve concerning management of the Denali wilderness. The use of stated choice analysis should be considered for studies of visitors' preferences in other wilderness areas. Results of such studies would provide a basis for comparison of wilderness users' preferences for wilderness setting conditions across different types of wilderness areas. Further, while much attention has been focused on the preferences and attitudes of overnight visitors to wilderness areas, the amount of research focused on day use visitors is more limited (Roggenbuck, Marion, & Manning, 1994). However, day use constitutes a substantial proportion of visitor use in many wilderness areas (Lucas, 1980; Manning, Ballinger, Marion, & Roggenbuck, 1996; Roggenbuck & Lucas, 1987). Stated choice analysis can further inform wilderness management decisions through studies of day use visitors' preferences for the conditions of social, resource, and managerial attributes of the wilderness experience.

References

- Adamowicz, W., Louviere, J., & Williams, M. (1994). Combining revealed and stated preference methods for valuing environmental amenities. Journal of Environmental Economics and Management, *26*, 271-292.
- Adamowicz, W., Boxall, P., Williams, M., & Louviere, J. (1998). Stated preference approaches for measuring passive use values: Choice experiments and contingent valuation. American Journal of Agricultural Economics, *80*, 64-75.
- Boxall, P., Adamowicz, W., Swait, J., Williams, M., & Louviere, J. (1996). A comparison of stated preference methods for environmental valuation. Ecological Economics, *18*, 243-253.
- Bryan, H. (1977). Leisure value systems and recreational specialization: The case of trout fishermen. Journal of Leisure Research, *9*, 174-187.
- Bullock, C., Elston, D., & Chalmers, N. (1998). An application of economic choice experiments to a traditional land use – Deer hunting and landscape change in the Scottish Highlands. Journal of Environmental Management, *52*, 335-351.
- Bultena, G., Albrecht, D., & Womble, P. (1981). Freedom versus control: A study of backpackers' preferences for wilderness management. Leisure Sciences, *4*(3), 297-310.
- Dennis, D. (1998). Analyzing public inputs to multiple objective decisions on national forests using conjoint analysis. Forest Science, *44*(3), 421-429.
- Ditton, R., Fedler, A., & Graefe, A. (1983). Factors contributing to perceptions of recreational crowding. Leisure Sciences, *5*, 273-288.
- Graefe, A., Donnelly, M., & Vaske, J. (1986). Crowding and specialization: A reexamination of the crowding model. In Proceedings – National Wilderness Research Conference: Current Research (Gen. Tech. Rep. INT-212, pp. 333-338). USDA, Forest Service.
- Green, P., & Srinivasan, V. (1978). Conjoint analysis in consumer research: Issues and outlook. Journal of Consumer Research, *5*, 103-123.
- Haider, W., & Ewing, G. (1990). A model of tourist choices of hypothetical Caribbean destinations. Leisure Sciences, *12*, 33-47.
- Hall, T. (in press). Use limits in wilderness. In Proceedings of the Use Density and Wilderness Experiences Workshop (Gen. Tech. Rep.). USDA, Forest Service, Rocky Mountain Research Station.
- Hanemann, W. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. American Journal of Agricultural Economics, *66*, 332-341.
- Hendee, J., Stankey, G., & Lucas, R. (1990). Wilderness management. Golden, CO: North American Press.
- Hosmer, D., & Lemeshow, S. (2000). Applied logistic regression. New York: John Wiley & Sons, Inc.
- Johnston, R., Swallow, S., & Weaver, T. (1999). Estimating willingness to pay and resource tradeoffs with different payment mechanisms: An evaluation of a funding guarantee for watershed management. Journal of Environmental Economics & Management, *38*, 97-120.
- Lawson, S., & Manning, R. (2000). Crowding versus access at Delicate Arch, Arches National Park: An indifference curve analysis. In Proceedings of the Third Symposium on Social Aspects and Recreation Research.
- Louviere, J., & Timmermans, H. (1990a). Stated preference and choice models applied to recreation research: A review. Leisure Sciences, *12*, 9-32.
- Louviere, J., & Timmermans, H. (1990b). Using hierarchical information integration to model consumer responses to possible planning actions: Recreation destination choice illustration. Environment and Planning, *22*, 291-308.
- Louviere, J., & Woodworth, G. (1985). Models of park choice derived from experimental and observational data: A case study in Johnston County, Iowa (Iowa City Technical Report). University of Iowa.
- Lucas, R. (1980). Use patterns and visitor characteristics, attitudes and preferences in nine wilderness and other roadless areas (Research Paper INT-253). USDA, Forest Service.
- Mackenzie, J. (1993). A comparison of contingent preference models. American Journal of Agricultural Economics, *75*, 593-603.
- Manning, R. (1999a). Crowding and carrying capacity in outdoor recreation: From normative standards to standards of quality. In Leisure studies for the twenty-first century (pp. 323-334). State College, PA: Venture Press.
- Manning, R. (1999b). Studies in outdoor recreation: Search and research for satisfaction. Corvallis: Oregon State University Press.
- Manning, R., Ballinger, N., Marion, J., & Roggenbuck, J. (1996). Recreation management in natural areas: Problems and practices, status and trends. Natural Areas Journal, *16*(2), 142-146.
- Manning, R., Valliere, W., Wang, B., & Jacobi, C. (1999). Crowding norms: Alternative measurement approaches. Leisure Sciences, *21*(2), 97-115.
- Merigliano, L. (1990). Indicators to monitor the wilderness recreation experience. In Managing America's enduring wilderness resource (pp. 156-162). St. Paul: University of Minnesota.

- Munley, V., & Smith, V. (1976). Learning-by-doing and experience: The case of whitewater recreation. Land Economics, 52, 545-553.
- Opaluch, J., Swallow, S., Weaver, T., Wessells, C., & Wichelns, D. (1993). Evaluating impacts from noxious facilities: Including public preferences in current siting mechanisms. Journal of Environmental Economics & Management, 24, 41-59.
- Roggenbuck, J., & Lucas, R. (1987). Wilderness use and user characteristics: A state-of-knowledge review. In Proceedings of the National Wilderness Research Conference: Issues, state-of-knowledge, future directions (Gen. Tech. Rep. INT-220, pp. 204-245). USDA, Forest Service.
- Roggenbuck, J., Marion, J., & Manning, R. (1994). Day users of the backcountry: The neglected national park visitor. Trends, 31(3), 19-24.
- Roggenbuck, J., Williams, D., & Watson, A. (1993). Defining acceptable conditions in wilderness. Environmental Management, 17(2), 187-197.
- Schroeder, H., Dwyer, J., Louviere, J., & Anderson, D. (1990). Monetary and nonmonetary trade-offs of urban forest site attributes in a logit model of recreation choice (Gen. Tech. Rep. RM-197, pp. 41-51). US Department of Agriculture, Forest Service.
- Seiden, E. (1954). On the problem of construction of orthogonal arrays. Annals of Mathematical Statistics, 25, 151-156.
- Shindler, B., & Shelby, B. (1992). User assessment of ecological and social campsite attributes. In Defining Wilderness Quality: The Role of Standards in Wilderness Management – A Workshop Proceedings (Gen. Tech. Rep. PNW-305, pp. 107-114). USDA, Forest Service.
- Stevens, T., Belkner, R., Dennis, D., Kittredge, D., & Willis, C. (2000). Comparison of contingent valuation and conjoint analysis in ecosystem management. Ecological Economics, 32, 63-74.
- Swallow, S., Weaver, T., Opaluch, J., & Michelman, T. (1994). Heterogeneous preferences and aggregation in environmental policy analysis: A landfill siting case. American Journal of Agricultural Economics, 76, 431-443.
- Teisl, M., Boyle, K., & Roe, B. (1996). Conjoint analysis of angler evaluations of Atlantic salmon restoration on the Penobscot River, Maine. North American Journal of Fisheries Management, 16, 861-871.
- Whittaker, D. (1992). Selecting indicators: Which impacts matter more? In Defining Wilderness Quality: The Role of Standards in Wilderness Management – A Workshop Proceedings (Gen. Tech. Rep. PNW-305, pp. 13-22). USDA, Forest Service.

Footnotes

¹ Stated choice analysis is based on the decision making framework of random utility theory, and is the basis of the analytical model used in this study. Refer to Hanemann (1984) for a comprehensive presentation of the random utility framework.

² Stated preference methods, including conjoint analysis, are related to stated choice methods, and are also used to evaluate public preferences for multiple attribute goods. Respondents to conjoint analysis studies are asked to rate or rank alternatives, rather than choose among alternatives. For a detailed discussion of conjoint ranking see Dennis (1998) and Mackenzie (1993). For a detailed discussion of conjoint rating see Mackenzie (1993), Stevens, Belkner, Dennis, Kittredge, and Willis (2000), and Teisl, Boyle, and Roe (1996).

³ The orthogonal fractional factorial design was constructed by Don Anderson of StatDesign Consulting, Evergreen, Colorado.

⁴ See Hosmer and Lemeshow (2000) for information about logistic regression analysis.

⁵ To test whether differences in utility associated with changes in the level of an attribute are significantly different than zero (e.g., the change in utility associated with a change in the opportunity to camp out of sight and sound of other groups from "All nights" to "Most nights"), two additional logistic regression analyses were performed. In the two additional analyses the wilderness setting attributes were represented in the statistical model using *dummy* coding rather than *effects* coding. Results of the additional analyses indicate that the difference in utility associated with being "Allowed to camp in any zone on any night" versus being "Required to camp in specified zones", and the difference in utility associated with "Most visitors are able to get a permit for their preferred trip" versus "Most visitors are able to get a permit for at least their second choice trip" are not significantly different than zero. All other utility differences associated with different levels of the attributes were found to be significantly different than zero.

⁶ See Opaluch, Swallow, Weaver, Wessells, & Wichelns (1993) for a demonstration of the methods used to calculate estimated voting proportions for management alternatives.

COPING, CROWDING AND SATISFACTION: A STUDY OF ADIRONDACK WILDERNESS HIKERS

Andrew K. Johnson

Graduate Student, Forest Recreation Resources Management, State University of New York, College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, New York 13210

Chad Dawson

Professor, Forest Recreation Resources Management, State University of New York, College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, New York 13210

Abstract: Hikers in the wilderness areas of New York's Adirondack Park use a combination of physical and cognitive coping behaviors to maintain satisfaction with their wilderness experience. A total of 102 hikers in 16 Adirondack wilderness areas were interviewed and asked to complete a single-page survey. The in-depth interviews and surveys of hikers' importance and satisfaction ratings for a set of wilderness characteristics and conditions were used to measure and describe Adirondack wilderness hikers' employment of the four coping behaviors of spatial displacement, temporal displacement, product shift and rationalization. Results indicate users were employing coping behaviors across four wilderness area use intensity categories, often in combination and with few differences in their overall satisfaction.

Introduction

Since explorers Verplanck Colvin, George Washington Sears and Bob Marshall tramped its woods and waters, and fought for their protection, New York's Adirondack Park has become a popular recreation destination. Of its 6.5 million acres, essentially half are in the public domain, open for various forms of recreational use, and protected by the landmark 'forever wild' clause of the state Constitution. The 1972 Adirondack Park State Land Master Plan (APSLMP) and its subsequent revisions, have established a system of designated wilderness in the Park that parallels that of the federal Wilderness Preservation System (NYS APA, 1987). New York now has 17 wilderness areas within the Adirondack Park, each with distinct natural and social conditions and characteristics and visitor use patterns.

As visitor use of some of these wilderness areas has increased, the ability of a wilderness hiker to have unconfined recreational experiences and to experience solitude may be disappearing in some areas while thriving in others. Hikers who are confronted with wilderness conditions that challenge their ability to have a satisfying recreational experience may rectify this dissonance through one or more of four coping behaviors.

The coping behaviors used by visitors came under study by recreation researchers as a potential explanation for the

consistently high satisfaction levels reported by recreationists despite concurrent reports of crowding (Cole et al., 1995). If wilderness visitors are able to alter their recreational experience, their expectations from it, or their perspectives of it, they may be able to maintain their satisfaction despite encountering conditions, such as crowding, that they saw as dissatisfying. Coping behavior theory is divided into two types of behaviors: physical and cognitive, both of which were adapted for recreation research from studies of stress coping and crowding done by urban sociologists (Graefe et al., 1984; Manning, 1999).

Physical coping, or displacement, occurs when a hiker changes their use pattern, removing themselves from the wilderness environment in which they felt, or expected to feel conflict. The hiker may be *displaced spatially* to a substitute wilderness environment that meets their needs, if one is available, or they may also be *displaced temporally* by altering the time at which they visit the wilderness to avoid conflict. Past research often defined displacement as a visitor movement away from conditions of user-user crowding (Heberlein & Shelby, 1977; Kuentzel & Heberlein, 1992; Shelby et al., 1988). Recent research indicates that this is perhaps too narrow a definition as hikers may be displaced by a number of factors that could cause dissatisfaction or conflict, including management actions (Hall & Cole, 2000).

Cognitive coping can take two forms: product shift and rationalization. *Product shift* is the process by which a hiker alters their expectations or perspectives of the wilderness opportunity to be in line with the conditions they encounter or expect to encounter (Shelby et al., 1988; Hammitt & Patterson, 1991; Shindler & Shelby, 1995). For example, a hiker may come to accept wilderness as a place in which they may encounter large numbers of other hikers and trailside and campsite litter. *Rationalization* is a reevaluating of the wilderness experience that occurs when a user weighs their investment in the wilderness opportunity against any dissatisfying conditions encountered (Manning & Cial, 1980; Stewart, 1992; Manning, 1999). Rather than view the trip as a waste of time or money, for example, the user will devalue dissatisfiers and place a higher value on positive aspects of the experience to rectify cognitive dissonance.

Past research has predominantly sought empirical evidence of user coping behaviors and also sought to determine their cause. While some success has been made documenting shifting patterns of use (Becker, 1981; Anderson & Brown, 1984; Shelby et al., 1988; Kuentzel & Heberlein, 1992), there has been limited success in establishing causal connections between user coping and crowded conditions and other wilderness experience dissatisfiers. Hall and Cole's (2000) recent paper is a decided change in this trend as they were able to document user displacement caused by user dissatisfaction with management actions.

The limited success of many past studies of user coping response is somewhat related to the research methods employed to attempt to measure coping behavior. Most past research has employed self-reporting mail surveys and

other off-site and impersonal methods, which have been unable to capture the complexity and opportunistic nature of user coping responses and satisfactions. This study makes use of a hybrid design, combining in-depth interviews conducted in the field, with field-administered surveys. The field interviews and survey attempted to measure and explain the employment and effectiveness of physical and cognitive coping behaviors by Adirondack wilderness hikers to avoid perceived dissatisfiers.

Methods

This study was exploratory in its design, as it attempted not only to measure the extent to which Adirondack wilderness hikers were employing physical or cognitive coping behaviors, but also to measure their effectiveness. Departing from past studies of coping, this study made use of qualitative in-depth interviews in an attempt to document and describe the complex nature of coping, a distinct advantage of the probing and adaptive qualitative interview method. To better understand the attributes of wilderness that hikers find important and factor in their satisfaction, a brief survey and Importance-Performance analysis of wilderness characteristics and conditions were used. This data was also used to measure the effectiveness of the four coping behaviors.

Both the interviews and surveys were administered in the field so that wilderness hikers could be questioned during the course of their recreational activity. The advantage to this technique is that the interviewer is able to probe hikers responses to questions, leaving less chance for misinterpretation, and encouraging the hiker to respond based on their current or actual experience. This technique attempts to avoid the concern that hikers surveyed through the mail weeks or even months after their wilderness experience may respond to questions either hypothetically, or with unrealistically positive memories of past trips. Individuals may tend to distance themselves from negative experiences and may more often remember the positive aspects of an experience.

The Adirondack Park serves as an excellent location to study coping behaviors as its 17 wilderness areas, that total over 1.02 million acres, provide a range of opportunities, contained in the Wilderness Opportunity Spectrum (Hendee et al., 1990). These areas have a range of visitor use intensity levels from a few hundred per year in the Pepperbox Wilderness to 140,000 in the High Peaks Wilderness Complex, all in relatively close proximity to each other and to major urban settings. One wilderness, the William C. Whitney Wilderness, was removed from the sample, because of its divergent visitor use pattern of canoeing and boating rather than hiking, and the remaining 16 areas were organized into four use level categories based on New York State Department of Environmental Conservation visitor data. Data collection was stratified between each of four Adirondack wilderness use level categories, which were set as: "Intensive Use," for the Eastern Zone of the High Peaks, with its estimated 123,000 user trips a year, with the remaining areas divided among "Heavy Use," "Moderate Use," and "Light Use." As

wilderness use densities are known to fluctuate between weekdays, weekends, and holidays (Dawson et al., 2001), sampling was stratified not only among the use level categories but also between weekdays, and weekends and holidays.

After encountering a hiker along the trail, asking for their cooperation in an interview, and obtaining permission to tape record the interview, each hiker was asked a set of 12 general questions. Opening questions in the interviews served to establish rapport with the hiker, and document their residency and past wilderness hiking experience. Hikers were then asked a series of questions that established whether or not they had coped with dissatisfying conditions in wilderness. Further questions were asked to probe hikers responses and to encourage them to elicit stories of their responses to dissatisfying or unexpected and undesirable conditions in wilderness. For example, hikers were asked if they had ever felt crowded in an Adirondack wilderness area, or encountered dissatisfying social conditions. If they responded that they had, follow-up questions were asked to determine if these dissatisfying experiences had caused them to be displaced from a preferred location, for example. Interviews took place at popular wilderness destinations like mountain peaks and ponds, in campsites, and also along trails wherever hikers were encountered.

After the interviews, which lasted from 15 minutes to an hour in length, each hiker was asked to fill out a single-page survey. The survey was comprised of a set of eight statements of wilderness characteristics and four statements of wilderness conditions. Hikers scored each statement on a six-point importance scale (0 to 5) and a five-point satisfaction scale (-2 to 2). The interview and survey sought similar information using different approaches to attempt to complement each other and capture a clearer understanding of the phenomenon of coping and displacement. The interviews asked hikers to relate stories of their experiences and use patterns of Adirondack wilderness in their own words, while the survey simply asked them to rate certain characteristics and conditions of wilderness.

At the end of the field season, interviews and interviewers comments and observations were transcribed and analyzed, in the qualitative thematic coding tradition, using *The Ethnograph* software package. Interview transcripts were read and analyzed in detail and selections of text were marked or coded as pertaining to a coping strategy or other important thematic elements. Data from the single-page surveys was entered and analyzed using the Statistical Package for the Social Sciences software (SPSS version 10.0 for Windows). Statistical tests included: chi-square statistics to test patterns of coping among the four use levels and independent sample t-tests of importance and satisfaction scores among coping or non-coping groups.

Importance-Performance analysis (I/P analysis) is an effective way to visually assess the relative significance of specific attributes on the overall satisfaction of a recreationist (Hammit et al., 1996; Smith & Tarrant, 1999).

In I/P analysis means of importance and performance – in this case, satisfaction – scores are plotted on the y and x-axis, respectively. Four quadrants are assigned the following labels and represent whether management attention is needed for various attributes: “Keep up the good work” (high satisfaction, high importance), “Possible Overkill” (high satisfaction, low importance), “Low Priority” (low satisfaction, low importance), and “Concentrate Here” (low satisfaction, high importance).

Results and Discussion

A total of 102 wilderness hikers were interviewed between Memorial Day and Labor Day of the summer of 2000, after spending 51 days and 36 nights interviewing on the trail, hiking approximately 390 miles in 16 wilderness areas and driving 5,941 miles between trailheads and home. On only one occasion did hikers decline to be interviewed – both were training for the Ironman Triathlon in Lake Placid and wouldn't stop running.

Of the 102 hikers interviewed, 66 were male and 36 female, ranging in age from 12 to 74 with a mean age of about 35 years. A majority of the sample was overnight hikers, with 72 camping out at least one night. The remaining 30 were day hikers, not spending a night in the wilderness. Most were residents of New York State, with 69 hikers reporting they lived in the state, while 23 were from other states and 10 resided in Canada.

A series of questions was asked to determine whether or not the individual had made use of any coping strategy. For example, one question asked of every hiker was: “Have you ever felt crowded in an Adirondack wilderness area and if so, what did you do about it?” As this series of questions was open ended and responses often the subject of probing following questions, qualitative analysis was used to make determinations regarding the employment of coping behaviors.

Of the 102 people interviewed, 54 had used one or more forms of coping behavior, while 48 had not. Physical coping behaviors were the most prevalent with 35 hikers employing temporal displacement, and 28 hikers employing spatial displacement. Cognitive coping behaviors were used to varying degrees, with 33 hikers using product shift, and 8 hikers using rationalization. What follows are examples of each of the four coping behaviors as reported by hikers in the sample.

Temporal Displacement

Qualitative determinations indicated that the 35 hikers employing temporal displacement were distributed across the spectrum of wilderness use intensity categories and were using the physical coping behavior in two ways. Hikers using temporal displacement were either shifting their time of wilderness use from weekends to weekdays, or from the summer season to either spring or fall. These hikers reasoned that the times they preferred, weekdays and the spring and fall, were times of lower use intensity in their preferred wilderness.

In the course of interviewing a 40-year-old Rochester, New York man in the Five Ponds Wilderness, he explained that

he had felt crowded by other users at various times hiking in the High Peaks Wilderness Complex (HPWC). Still wanting to hike in the HPWC, this man and his wife described their strategy of avoiding dissatisfying situations of crowding this way:

Yeah, like Johns Brook, we [are] going to do towards the end of this month and we're not going to start until Monday. Just because I know going up to Johns Brook Pass there will be a lot of weekend warriors and I hope to let them clear out if they are [hiking] on a weekend. And then, on a non-holiday setting for the week, I'm hoping that [it] is going to cut down on traffic. So, we are going to come in from the Garden [Trailhead] on a weekday just for that reason.

This hiker and his wife were making use of temporal displacement to maintain their satisfaction with the HPWC, avoiding the Johns Brook Valley corridor on a weekend as in the past they had felt crowded by the number of other users there. This man and his wife were not alone in their attempts to avoid feeling crowded by “weekend warriors,” among many other potential dissatisfiers.

Spatial Displacement

A total of 28 hikers interviewed reported changes in the use of Adirondack wilderness areas that indicated they were spatially displaced. Like those hikers temporally displaced, the spatial displaced hikers were using the behavior in two ways. These hikers were either being displaced from one wilderness area to another (inter-wilderness displacement) or from one location in a wilderness area to another (intra-wilderness displacement).

Crowding in the Eastern Zone of the HPWC has spatially displaced one 24-year-old woman, from Warner, New Hampshire, interviewed at the Uphill Brook Lean-to, in the HPWC, a few miles from Lake Colden. She reported feeling crowded and was dissatisfied with litter and waste she saw when hiking past Marcy Dam and Lake Colden.

I am just like, whoa, I can't imagine wanting to stay at either of those places. It is just, it is not really a wilderness experience when you have that many people out there and they're noisy.

She reported she had been displaced to lesser-used parts of the HPWC, indicating she was using intra-wilderness displacement. Though she said she would never camp at Marcy Dam or Lake Colden, she said she would consider hiking through those areas if there was a specific wilderness destination she wanted to access that required passing through there. This is evidence of cognitive coping behavior use as well.

Product Shift

This cognitive coping behavior was the second most commonly used coping behavior among hikers in this study, as indicated by their responses to interview questions. A total of 33 hikers reported cognitive changes

in their expectations or perspectives of a wilderness experience to accommodate conditions they encountered.

For example, one 48-year-old male hiker from Rochester, New York, interviewed in the Siamese Ponds Wilderness placed a high value on solitude and preferred to hike in wilderness areas with a low use intensity level. However, he also liked hiking with a group of friends, who sometimes hiked in the HPWC for the high peaks experience. As a result, he made use of product shift to maintain his satisfaction in the face of dissatisfying crowding on a HPWC peak:

If the other guys all wanted to do one, I would do it. But, I know what to expect and wouldn't be disappointed.

This hiker, based on previous experience with crowding in the HPWC had redefined that wilderness experience and now expected to encounter crowding when hiking there. Product shift was allowing this hiker to join his friends on a HPWC trip and be satisfied overall with that trip despite not being able to experience the solitude he valued. While had redefined the HPWC experience, some hikers used rationalization to revalue the wilderness experience.

Rationalization

For some hikers their investment in the wilderness experience, in time and money for example, is of more value than dissatisfying conditions like crowding, and they are rationalize satisfaction from their trip. This cognitive behavior adaptation proved difficult to measure, perhaps as it likely occurs subconsciously, with only eight hikers in the sample determined to be using it.

A 26-year-old Canadian hiker interviewed on Mount Marcy in the HPWC said the trail erosion, human impacts and large numbers of other hikers he had encountered were "just part of the deal," and would not dissuade him from hiking in the High Peaks because "they are close, they are very accessible, and of course free." Unable to invest the time and money necessary to hike in the wild expanses of northern and western Canada, this Ottawa man chose the HPWC and reported being satisfied overall with his experience there.

Coping behaviors were clearly being used by these Adirondack hikers to maintain their satisfaction with their wilderness experience. Chi-square tests yielded no statistically significant differences between the four wilderness area use intensity categories for those using no coping behaviors and those making use of coping behaviors (Table 1) (Chi-square = 4.3; df = 3; p = 0.24). Theoretically, coping behavior employment should have some relation to wilderness use intensity. Hikers making use of spatial displacement would likely be found in areas with a lower use intensity level, while hikers coping cognitively would likely be found in areas with a higher use intensity level. The equal distribution of physical and cognitive coping behavior use across wilderness area use intensity categories is likely due to a balancing effect of spatially displaced hikers in lesser-used areas while hikers coping cognitively were found in high use intensity areas.

Table 1. Comparisons of Sample Size and Percentage between Coping Behavior Usage and Wilderness Area Use Intensity Category in 16 Adirondack Wilderness Areas in 2000

Wilderness Area Use Intensity	N	No Coping Behavior Use	Coping Behavior Use
Light	N	8	5
Moderate	N	16	28
Heavy	N	16	12
Intensive	N	8	9
Total	N	48	54

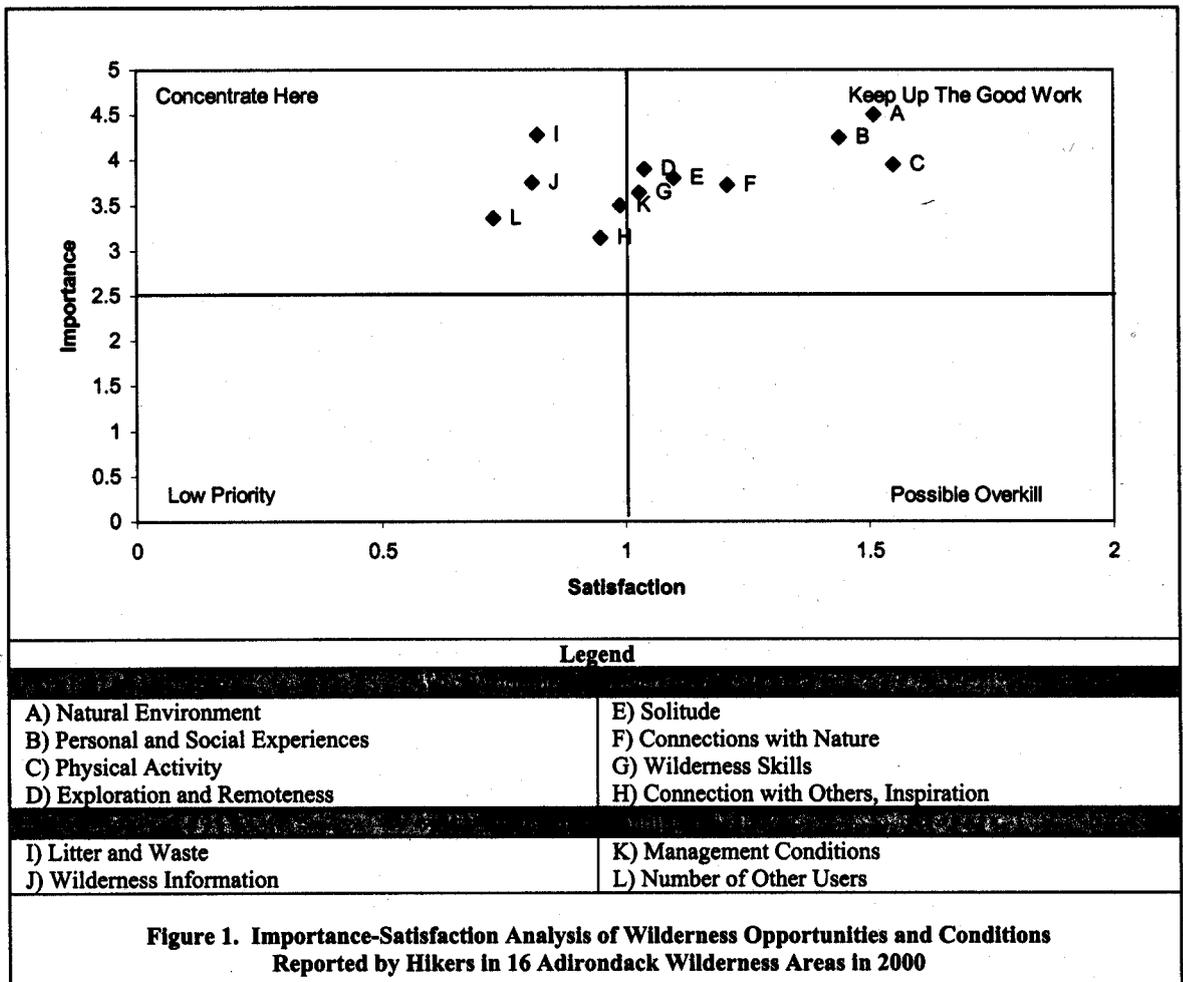
Importance and satisfaction scores from the entire sample indicate that Adirondack wilderness managers are, in general, providing the quality of experience that these Adirondack wilderness users were seeking. Importance and satisfaction means for each of the 12 wilderness characteristics and conditions were high (Table 2). In addition, these high mean scores indicate wilderness visitors are using coping behaviors to maintain their satisfaction.

Table 2. Mean Importance and Satisfaction Scores with 12 Wilderness Characteristics and Conditions for 102 Adirondack Wilderness Hikers Interviewed in 2000

Attribute	Importance	Satisfaction
Natural Environment	4.50 ^a	1.51
Personal & Social Experiences	4.25	1.44
Physical Activity	3.95 ^a	1.55
Exploration & Remoteness	3.90	1.04 ^a
Solitude	3.80	1.10
Connections with Nature	3.72	1.21
Wilderness Skills	3.64 ^a	1.03
Connection with Others, Inspiration	3.14	0.95
Litter and Waste	4.28	0.82 ^a
Wilderness Information	3.75	0.81
Management Conditions	3.50	0.99
Number of Other Users	3.36	0.73 ^a

^a Statistically significant t-test differences (alpha = 0.05) between the mean scores of those using and those not using coping behaviors.

Due to the high importance and satisfaction means for every attribute, the quadrant lines, based on the grand mean of means, were not included in Figure 1, as is traditional in I/P analysis. The reasoning for this change is the very high level of importance ratings for all 12 variables. Rather than drawing quadrant lines on the grand mean of means, the figure was divided on middle of the importance scale at 2.5, and on the upper quarter of the satisfaction scale at 1 (satisfied).



Highest importance and satisfaction were placed on the quality of the natural environment (attribute A), personal and social experiences in wilderness (attribute B) and with the physical activity component of the wilderness experience (attribute C). Hikers were also highly satisfied, but placed a slightly lower importance on their ability to make connections with nature (attribute F).

Interestingly what is considered a hallmark of any wilderness experience, solitude (attribute E) fell almost exactly on the grand mean of means for both importance and satisfaction. Attributes for all four wilderness conditions, such as litter and waste (attribute I), had lower satisfaction ratings in relation to their high importance ratings, indicating each condition should be of some concern to wilderness managers.

The importance and satisfaction survey data was further analyzed in conjunction with the qualitative determinations of whether a hiker was using a coping behavior. The importance and satisfaction scores of those who had made use of any of the four coping behaviors were separated from those who used no coping behavior. Mean scores for each group were compared using independent sample t-tests with a significance level set at $\alpha = 0.05$.

Of the 12 importance attributes, three showed statistically significant differences between those making use of some coping behavior and those not using any (Table 2). Those hikers who had not used a coping behavior in Adirondack wilderness placed a higher importance on the physical challenge of their wilderness experience, improving their wilderness travel skills, and their enjoyment of the natural wilderness environment than those using coping behaviors.

Differences were found for three of the 12 satisfaction attributes, where three were found to have statistically significant differences between those using a coping behavior and those not (Table 2). However, the three statistically significant importance attributes were not the same as the three statistically significant satisfaction attributes. Those using coping behaviors were less satisfied with the amount of litter, number of other users encountered on a wilderness trip, and exploration and remoteness in wilderness than those not using coping behaviors.

Study Implications

High overall satisfaction levels with few significant differences between those who have made use of coping behaviors and those who have not, coupled with the fact

that both groups were evenly distributed across the spectrum of wilderness use level categories, indicates a greater complexity and interaction of coping behavior employment than was previously expected. So, while the hikers in this group who have and have not made use of coping behaviors may have been standing on the same mountain peak or beside the same pond, they were looking at the wilderness around them with different eyes, seeing a different place, and having different experiences.

There were hikers in the sample that were indeed seeking solitude and wildness and were using coping behaviors to ensure that they found those conditions. However, there were also those who, regardless of parking difficulties, frequent contact with other users, eroded trail conditions, and noisy campsites, said they will keep returning to the highly used Eastern Zone of the High Peaks Wilderness Complex, or to the crowded summit of Giant Mountain on a holiday weekend as these things simply do not reduce their satisfaction. Maybe it is a physical challenge and mountain views they are seeking and as long as their ability to feel the burn in their legs and lungs on the way to a summit view is not impeded by social or managerial conditions, their satisfaction remains high.

So while these Adirondack wilderness hikers may, at times, perceive crowding from other wilderness visitors, coping behaviors are working to allow them to maintain high satisfaction levels. Those making use of coping behaviors were less satisfied with the amount of litter, number of encounters with other hikers, and the sense of exploration and remoteness (in other words, the wildness of wilderness) and considered the physical challenge, improvement of wilderness skills, and the natural wilderness environment to be less important than those not using any coping behaviors.

Wilderness managers and recreation researchers should note that results of this study lend empirical evidence to what researchers have long expected about coping behavior employment – that hikers were using coping behaviors to maintain their satisfaction with certain wilderness characteristics and conditions.

Acknowledgements

This study was funded under support from the SUNY College of Environmental Science and Forestry, McIntire-Stennis Program, and the Aldo Leopold Wilderness Research Institute.

Literature Cited

- Anderson, D. H., & Brown, P. J. (1984). The displacement process in recreation. Journal of Leisure Research, 16(1), 61-73.
- Becker, R. H. (1981). Displacement of recreational users between the Lower St. Croix and Upper Mississippi Rivers. Journal of Environmental Management, 13, 259-267.
- Cole, D. N., Watson, A. E., & Roggenbuck, J. W. (1995). Trends in wilderness visitors and visits: Boundary Waters Canoe Area, Shining Rock, and Desolation Wilderness (Research Paper INT-RP-483). Ogden, UT: USDA Forest Service, Intermountain Research Station.
- Dawson, C. P., Simon, M., Oreskes, R., & Davis, G. (2001). Great Gulf Wilderness use estimation: Comparisons from 1976, 1989, and 1999. In G. Kyle (Comp., Ed.), Proceedings of the 2000 Northeastern Recreation Research Symposium (Gen. Tech. Rep. NE-276, pp. 283-288). Newtown Square, PA: USDA, Forest Service, Northeastern Research Station.
- Graefe, A. R., Vaske, J. J., & Kuss, F. R. (1984). Social carrying capacity: An integration and synthesis of twenty years of research. Leisure Sciences, 6(4), 395-431.
- Hall, T., & Cole, D. N. (2000). An expanded perspective on displacement: A longitudinal study of visitors to two wildernesses in the Cascade Mountains of Oregon. In Proceedings of the Wilderness Science in a Time of Change Conference: Vol. 4. Wilderness visitors, experiences, and visitor management (RMRS-P-15-VOL-4, pp. 113-121). USDA, Forest Service, Rocky Mountain Research Station.
- Hammitt, W. E., Bixler, R. D., & Noe, F. P. (1996). Going beyond Importance-Performance Analysis to analyze the observance-influence of park impacts. Journal of Park & Recreation Administration, 14(1), 45-62.
- Hammitt, W. E., & Patterson, M. E. (1991). Coping behavior to avoid visitor encounters: Its relationship to wildland privacy. Journal of Leisure Research, 23(3), 225-237.
- Heberlein, T. A., & Shelby, B. (1977). Carrying capacity, values, and the satisfaction model: A reply to Greist. Journal of Leisure Research, 9(2), 142-148.
- Hendee, J. C., Stankey, G. H., & Lucas, R. C. (1990). Wilderness management. Golden, CO: Fulcrum Publishing.
- Kuentzel, W. F., & Heberlein, T. A. (1992). Cognitive and behavioral adaptations to perceived crowding: A panel study of coping and displacement. Journal of Leisure Research, 24(4), 377-393.
- Manning, R. E. (1999). Studies in outdoor recreation: Search and research for satisfaction. Corvallis, OR: Oregon State University Press.
- Manning, R. E., & Ciali, C. P. (1980). Recreation density and user satisfaction: A further exploration of the satisfaction model. Journal of Leisure Research, 12(4), 329-345.
- New York State Adirondack Park Agency. (1987). Adirondack Park State Land Master Plan. Ray Brook, NY: Author.

Shelby, B., Bergenzer, N. S., & Johnson, R. (1988). Oregon Rivers. Journal of Leisure Research, 20(4), 274-288.

Shindler, B., & Shelby, B. (1995). Product shift in recreation settings: Findings and implications from panel research. Leisure Sciences, 17, 91-107.

Smith, E. K., & Tarrant, M. A. (1999). Boosting confidence in Importance-Performance Analysis: An explanation and

Displacement and product shift: Empirical evidence from application of an I/P modification. In G. Kyle (Comp., Ed.), Proceedings of the 1999 Northeastern Recreation Research Symposium (Gen. Tech. Rep. NE-269, pp. 172-176). Newtown Square, PA: USDA, Forest Service, Northeastern Research Station.

Stewart, W. P. (1992). Influence of the onsite experience on recreation experience preference judgments. Journal of Leisure Research, 24(2), 185-198.

PERCEIVED CROWDING AT BOSTON HARBOR ISLANDS NATIONAL PARK AREA

Megha Budruk

Graduate Research Assistant, School of Natural Resources,
University of Vermont, Burlington, VT 05405

Robert E. Manning

Professor, School of Natural Resources, University of
Vermont, Burlington, VT 05405

William A. Valliere

Research Data Specialist, School of Natural Resources,
University of Vermont, Burlington, VT 05405

Benjamin Wang

Research Data Specialist, School of Natural Resources,
University of Vermont, Burlington, VT 05405

Abstract: The increasing popularity of outdoor recreation has led to concerns about the level and types of visitor use that can be accommodated in parks and related areas without causing unacceptable impacts to the recreation experience. Such impacts represent the social component of carrying capacity, and include perceived crowding. Crowding within recreation environments has received substantial research attention. However, most studies have been in wilderness or river recreation settings. Perceived crowding is not free of physical settings. Research indicates that perceptions of crowding do in fact differ by site and therefore exploring crowding perceptions in a diversity of recreation areas. This study focuses on perceived crowding at Boston Harbor Islands National Park Area, a new unit of the national park system in the Boston metropolitan area. During the summer of 2000, randomly selected visitors at the Boston Harbor Islands completed an onsite survey. Results indicate that most visitors to the islands do not feel crowded. However, a number of other impacts that affect the recreation experience were identified. Several management implications are apparent.

Introduction

The increasing popularity of outdoor recreation has led to concerns about the impacts of rising visitation. Initial concerns focused on impacts on environmental resources. However, it soon became clear that the recreation experience was affected too. In his monograph titled "The Carrying Capacity of Wild Lands for Recreation," Wagar (1964) noted that increasing visitor use affected not only environmental resources but the quality of the recreation experience. Concerns over the impacts on the recreation experience led to a growing interest in the issue of crowding. The notion that there is some level of visitor use beyond which the quality of the recreation experience diminishes to an unacceptable degree forms the basis of the concept of social carrying capacity. This concept has

provided a framework for theoretical and empirical research on crowding.

Crowding in parks and related areas is the focus of a large and growing body of scientific literature. Crowding has been defined as "a negative and subjective evaluation that the specified number is too many" (Shelby et al., 1989). Crowding is often interpreted as a normative concept, dependent on a number of factors and circumstances. Most of the early crowding studies were conducted in wilderness or river recreation settings. However, since the early 1990s researchers have begun to study crowding in a variety of other recreation settings such as national monuments (Andereck & Becker, 1993; Manning, Valliere, Wang, Lawson & Treadwell, 1999) and natural history museums (Budruk, 2000).

Factors Influencing Crowding

The literature on crowding in parks and related areas indicates that a variety of factors can influence crowding perceptions (Manning, 1985; Manning, 1999). These can be broadly grouped into three categories: visitor characteristics, characteristics of those encountered and situational variables.

Visitor characteristics such as recreation activity engaged in, motivations for outdoor recreation, preferences and expectations for use levels, experience level and attitudes toward management have been shown to influence crowding perceptions. For example, in their study of visitors at a national park in Alaska, Bultena, Field, Womble and Albrecht (1981), examined hikers' preferences and expectations for seeing others. Respondents indicated feeling more crowded when contacts with others exceeded their preferences or expectations.

The character of others encountered can also influence perceived crowding. Such factors include type and size of group, behavior, and the degree to which groups are perceived to be alike. For example, a study of crowding at an intensively developed outdoor recreation site by Gramann and Burdge (1984), indicated that crowding perceptions were positively related with recreationists' exposure to threatening behavior of other visitors.

The situation in which encounters take place has also shown to influence perceived crowding. Factors such as type and accessibility of a recreation area, location within an area, time or season, and environmental quality and design can influence crowding perceptions. Results of a study of visitors to a wilderness area in West Virginia by Vaske, Graefe and Dempster (1982) indicate that perceived crowding is influenced by environmental impacts left by others.

Measuring Crowding

Over the years, crowding has been measured in a variety of ways, both as a single composite item as well as a multiple-item scale. Examples of single composite items include a four-level categorical response scale ranging from "no, not

at all" to "yes, very crowded" (Westover & Collins, 1987); a seven-point Likert scale with the following categories: "not at all crowded", "slightly crowded", "moderately crowded", and "extremely crowded" (Bultena et al., 1981); and a qualitative measure asking "how do you feel about the number of others around here tonight" (Absher & Lee, 1981). Other studies have used multiple-item scaling techniques. In a study on use levels and crowding on the Colorado River in the Grand Canyon National Park, Shelby (1976), used a nine-item scale with a 0.91 reliability coefficient (as cited in Shelby, Vaske & Heberlein, 1989). However, the use of multiple-item scales has inherent problems even though such scales can be reliable and allow the researcher to examine multiple dimensions of crowding perceptions. Multiple-item scales can place a substantial burden on respondents. Further, combining multiple items into a single crowding scale score can make comparing of results difficult. Finally, the results themselves may be less intuitively meaningful and therefore less directly useful to decision-makers (Shelby et al., 1989).

Heberlein and Vaske (1977) have attempted to overcome these problems by developing a nine-point single-item measure of crowding that asks respondents to indicate how crowded the site was at the time of their visit. The scale is designed such that seven of the nine points measure varying degrees of crowding, therefore allowing the scale to be sensitive to even slight degrees of perceived crowding. This single-item crowding measure has been used in both experimental as well as theoretical studies. It has been shown to be useful in a variety of recreation activities including hunting, boating, hiking, fishing, museum visitation, and recreation settings such as backcountry, frontcountry, rivers and museums. In a study comparing crowding perceptions at multiple locations (Shelby et al., 1989), this single-item nine-point Likert scale was both useful and reliable. This nine-point, single-item measure of crowding has been widely adopted in the crowding literature.

Boston Harbor Islands National Park Area

Unlike other national parks, Boston Harbor Islands National Park Area is managed by a partnership of a thirteen-member board appointed by the U.S. Secretary of the Interior, representing the National Park Service, a range of federal, state and local agencies, and private organizations. It represents a unique recreation setting for a number of reasons. First, the National Park Area is located adjacent to downtown Boston, a major cultural and economic metropolitan area in New England. Approximately forty million people live within 250 miles of the park. Second, the National Park Area comprises over 30 islands, containing a wide diversity of natural, cultural and historic resources. Finally, the islands offer a variety of recreation experiences including camping, wildlife observation, boating, fishing, historic tours and solitude. Currently, six islands are open seasonally to the public, free of charge, and have park staff or volunteers to welcome visitors. Ferries are used to transport visitors from the mainland to the various islands.

Study Objectives and Methods

The overall purpose of this study was to formulate social-based indicators and standards of quality relevant to the Park's management objectives. Specific objectives were to analyze park use patterns, identify potential indicators of quality and evaluate and select indicators of quality for park management zones. Questionnaires were developed for visitors to six areas within the park: the ferry from Long Wharf to George's Island, the ferry from Hingham to George's Island, World's End, Little Brewster Island, Deer Island and Thompson Island. Data collection was conducted during the summer of 2000 using on-site visitor surveys. A total of 695 visitors were surveyed between the end July and the beginning September. The survey was conducted on 8 weekend days and 9 weekdays between 9:00am and 6:00pm.

Study Findings

Visitor Characteristics

The average age of respondents was 41 years. Most visitors were relatively well educated averaging 16.5 years of formal education. The sample was relatively well balanced by gender with 54.2% of respondents female and 45.8% male. Respondents were primarily white (82.6%), followed by Asians (2.6%), African Americans (2.4%), and American Indian or Alaskan Natives (0.6%). The plurality of respondents were from Boston (22.6%) or surrounding communities (48.3%). International visitors comprised 4.1% of the sample.

Visitation Characteristics

A little over half of the sample (54.1%) were first time visitors. However these results varied among sites. Visitors to Deer Island (77.8%), Little Brewster (96.7%), and Thompson Island (76.5%) were primarily first-time visitors. World's End received a comparatively smaller percentage of first-time visitors (26.9%). Two-fifths of respondents (39.1%) on the ferry from Hingham, and a half of those (54.8%) on the ferry from Long Wharf were first-time visitors. Respondents visited primarily in groups consisting of family (39.8%) or friends (23.4%). Average group size was around 15 people with a median of 5.

Visitor Experiences

Popular recreation activities at Boston Harbor Islands include walking/ hiking (80.1%), sightseeing (73.1%), touring historical/cultural sites (46.2%) and picnicking (45.3%). Visitors on the Hingham ferry reported walking/hiking (24.3%) and sightseeing (23.0%) as their primary recreation activity. Visitors on the Long Wharf ferry reported sightseeing (28.3%) to be their main activity. Each island has a variety of recreation activities to offer, and primary activities reported at other sites included sightseeing (43.2%), and touring historical/cultural sites (32.4%) at Little Brewster Island; walking/hiking (36.4%) and touring cultural/ historical sites (27.3%) at Thompson

Island; sightseeing (81.7%) at World's End; and sightseeing (100%) at Deer Island.

Elements of the experience enjoyed most by respondents included scenery/views (20.2%), Fort Warren (12.9%), specific activities like hiking or beachcombing (9.1%), and peace and quiet (9.0%). Respondents indicated that lack of or poor maintenance of facilities (24.3%), lack of information (7.5%) and infrequent ferry schedules (6.9%) detracted from the enjoyment of the visit.

When asked about what they thought should be changed about the way visitors experience Boston Harbor Islands, two-fifths of respondents (40.5%) indicated that everything was fine the way it is. However, others indicated a need for more information/ education (16.8%), and more facilities and services (15.7%).

Crowding at the islands does not appear to be an important issue. Nearly three-fourths of respondents (72.7%) indicated not feeling crowded at all. Overall crowding perceptions averaged a relatively low 2.1 on the nine-point Likert scale. Nearly all respondents indicated that they were satisfied with their recreation experience.

Visitor Impacts

Overall, a little over a tenth of respondents (14.9%) indicated that visitors are causing negative impacts to the Boston Harbor Islands. Litter, broken glass, trash, garbage, graffiti, vandalism, crowding, unsupervised children and noise were the most commonly cited impacts. Around one-fourth of respondents (23.5%) were unsure if any negative impacts were occurring.

Discussion and Management Implications

The Boston Harbor Islands Partnership is in the process of preparing a general management plan that will provide a foundation to guide and coordinate all subsequent planning and management. The plan suggests that managers desire to increase visitor numbers to the park. Findings suggest that most visitors to the Boston Harbor islands do not consider the area to be crowded. This suggests that carrying capacity at the islands has not yet been approached. Management may therefore appropriately encourage an increase in visitor use.

The literature on crowding indicates that party size affects crowding norms (Manning, 1985). A majority of visitors prefer encounters with more small-sized groups as compared to few large-sized groups (Lime, 1972, Stankey, 1973). Study results indicate that around a third of groups that visit the islands consist of ten or more persons, which is fairly large for an outdoor recreation site. An increase in use at the islands may result in a subsequent increase in large visitor groups, potentially detracting from the visitor experience. Managers might therefore need to vary use levels at different islands to ensure a range of experiences from solitude to group related activities.

Crowding is now not an issue at Boston Harbor Islands National Park Area. With increasing use levels however, this may change. As noted earlier, crowding is a normative concept. It is a value judgment influenced by many factors. The literature on crowding suggests that factors other than the number of visitors can influence crowding perceptions. These factors include situational variables and characteristics of others encountered. When asked about negative impacts, 14.9% of respondents indicated they felt visitors were causing negative impacts to the park area. These impacts include litter, broken glass, trash, garbage, graffiti, vandalism, unsupervised children and noise. Such factors may at some point begin to exacerbate crowding perceptions. Managers may therefore need to monitor and evaluate these potential impacts.

Recreation carrying capacity is a useful concept in outdoor recreation, and includes natural resource and social components. Clearly, resource conditions (litter, graffiti) and social conditions (use levels) are inter-related and affect perceived crowding. Managing for perceived crowding will therefore require an integrated approach that includes both natural resource as well as social considerations.

Research on crowding in outdoor recreation indicates that visitors often have standards by which they judge a situation as crowded or not. Shelby et al. (1989) suggest that "when people evaluate an area as crowded, they have at least implicitly compared the impact that they experienced with their perception of a standard." It is therefore important that managers at the Boston Harbor Islands National Park Area develop indicators and standards of quality for both resource and social conditions. These indicators and standards of quality might vary by island, recreation opportunity and management agency.

Conclusion

Boston Harbor Islands National Park Area is a unique recreation setting that offers a variety of recreation activities. The park does not have a crowding problem at current use levels. However, with increasing use levels, this may change. The normative approach toward crowding suggests that crowding is influenced by a number of factors such as impacts to environmental resources. Managers therefore need to pay attention to problems of litter, graffiti, noise, and vandalism that are present on the islands. Managing for carrying capacities at the islands will require an integrative approach that encompasses both natural resource as well as social considerations. Finally, managers are encouraged to establish indicators and standards of quality for both resource and social conditions. These standards might vary by island, recreation opportunity and management agency.

References:

Absher, J. D., & Lee, R. G. (1981). Density as an incomplete cause of crowding in backcountry settings. *Leisure Sciences*, 4(3), 231-247.

- Andereck, K. L., & Becker, R. H. (1993). The effects of density on perceived crowding in a built recreation environment. Journal of Applied Recreation Research, 18(3), 165-179.
- Budruk, M. (2000). Perceived crowding and satisfaction among desert museum winter visitors. Unpublished master's thesis, Arizona State University, Tempe.
- Bultena, G., Field, D., Womble, P., & Albrecht, D. (1981). Closing the gates: A study of backcountry use limitation at Mount McKinley National Park. Leisure Sciences, 4(3), 249-267.
- Gramann, J. H. & Burdge, R. J. (1984). Crowding perception determinants at intensively developed outdoor recreation sites. Leisure Sciences, 6(2), 167-186.
- Heberlein, T. A., & Vaske, J. J. (1977). Crowding and visitor conflict on the Bois Brule River (Technical Report, Office of Water Resources Project #A-006-WAS). The University of Wisconsin, Madison.
- Manning, R. E. (1985). Crowding norms in backcountry settings: A review and synthesis. Journal of Leisure Research, 17(2), 75-89.
- Manning, R. E. (1999). Studies in outdoor recreation: Search and research for satisfaction (2nd ed.). Corvallis: Oregon State University Press.
- Manning, R. E., Valliere, W., Wang, B., Lawson, S., & Treadwell, J. (1999). Visitor management at Statue of Liberty/ Ellis Island National Monuments. Burlington: University of Vermont, School of Natural Resources.
- Shelby (1976). Social psychological effects of crowding in wilderness. The case of river trips in the Grand Canyon. Ph.D. dissertation, University of Colorado, Boulder.
- Shelby, B., Vaske, J. J., & Heberlein, T. A. (1989). Comparative analysis of crowding in multiple locations: Results from fifteen years of research. Leisure Sciences, 11, 269-291.
- Vaske, J. J., Graefe, A. R., & Dempster, A. (1982). Social and environmental influences on perceived crowding. Paper presented at the third annual meeting of the Wilderness Psychology Group, Morgantown, WV.
- Wager, J. A. (1964). The carrying capacity of wild lands for recreation (Forest Science Monograph 7). Washington, DC: Society of American Foresters.
- Westover, T. N., & Collins, J. (1987). Perceived crowding in recreational settings: An urban case study. Leisure Sciences, 9, 87-99.

TRANSPORTATION PLANNING AND SOCIAL CARRYING CAPACITY IN THE NATIONAL PARKS

William Valliere

Researcher, University of Vermont, School of Natural Resources, Burlington, VT 05405

Robert Manning

Professor, University of Vermont, School of Natural Resources, Burlington, VT 05405

Megha Budruk

Graduate Research Assistant, University of Vermont, School of Natural Resources, Burlington, VT 05405

Steven Lawson

Graduate Research Assistant, University of Vermont, School of Natural Resources, Burlington, VT 05405

Benjamin Wang

Researcher, University of Vermont, School of Natural Resources, Burlington, VT 05405

Abstract: The U.S. national park system accommodates nearly 300 million visits annually. Most visitors come to the national parks in automobiles, and this poses several management challenges. Delays at national park entrances caused by traffic congestion detract from the visitor experience. Inadequate parking facilities further compromise the visitor experience and lead people to park along roadsides, damaging park resources and causing traffic hazards. At times, visitors must be turned away from some national park areas because transportation infrastructure is not sufficient to meet visitor demand.

National Park Service transportation planning has focused on addressing these issues through development of alternative public transportation systems. A number of national parks are planning and operating public transportation and shuttle systems to reduce visitors' reliance on personal transportation. While new transportation systems may mitigate traffic congestion and parking problems, these systems could potentially cause other problems. For example, the fleet size, scheduling, and routing of transportation systems can directly affect the number and distribution of visitors in a national park. Efforts to design transportation systems that protect and enhance the quality of the visitor experience in national parks can be improved with information about the social carrying capacity of these areas.

This paper presents carrying capacity research conducted to support planning in Yosemite National Park. Crowding-related standards of quality were formulated in heavily visited areas of this national park. A simulation model was developed to estimate the relationship between crowding-

related standards of quality and visitor use levels and distribution. This information can be used to assist national park managers to design and operate transportation systems that integrate considerations of social carrying capacity.

Introduction

Our national parks contain important natural, cultural, and historical resources. Their importance is reflected in the fact that they currently receive nearly 300 million visits per year (National Park Service, 2001b). With increasing visitor use comes potential impacts to park resources and the visitor experience. Most visitors to national parks come via private automobile. Reliance on the automobile challenges park managers with a host of management issues that include traffic congestion, insufficient or inadequately managed parking, noise, and limited opportunities to use non-motorized travel or alternative transportation modes. The interaction between impacts created by automobile traffic, park resources and the visitor experience is the focus of this paper. Changes to transportation systems within national parks can potentially affect the visitor experience. These effects can be positive, or as we will demonstrate, potentially negative, depending on how alternative transportation systems are designed and developed.

In this paper, we will:

- Demonstrate the historic connection between transportation and the national parks
- Outline current thinking about transportation planning in the parks
- Describe management challenges associated with transportation planning
- Demonstrate linkages between transportation and social carrying capacity
- Provide demonstrations of different transportation scenarios as they relate to social carrying capacity
- Demonstrate how transportation planning can be informed by carrying capacity research and vice versa

The Historic Roots of Transportation in the National Parks

Transportation to and in national parks has not always been considered a problem by national park officials. In fact, mechanized transportation was important to the growth and success of the national park system. Early efforts by railroad operators to bring visitors to national parks brought political and economic support to the fledgling park movement. While the motivations of early railroad barons may not have been fully altruistic, their support of the preservation movement lent a utilitarian air to an argument that was passionate, but otherwise lacking in pragmatic basis. In fact, support by railroads may have helped with the creation of the National Park Service. With the Union Pacific railroad's "See America First" campaign, growing numbers of tourists were encouraged to visit the national parks, thus giving the national park movement national recognition (Runte, 1997).

With the advent of the mass produced automobile, the popularity of national parks blossomed. Many early preservationists embraced the presence of automobiles in the national parks. The growing availability of automobiles to the middle class helped the national parks capture even greater public support. The few "purists" or as Edward H. Hamilton, correspondent for *Cosmopolitan* magazine dubbed them, "nature cranks," were outvoted by the large majority of preservationists who initially embraced the automobile as an opportunity to increase public popularity of the national parks (Runte, 1997). In fact, even John Muir accepted automobiles into his beloved Yosemite to increase public support for preservation of the parks. In a letter to Howard Palmer, Secretary of the American Alpine Club, Muir wrote "all signs indicate automobile victory, and doubtless, under certain precautionary restrictions, these useful, progressive, blunt-nosed mechanical beetles will hereafter be allowed to puff their way into all the parks and mingle their gas-breath with the breath of the pines and waterfalls, and, from the mountaineer's standpoint, with but little harm or good" (Bade, 1924).

The popularity of visiting national parks by automobile grew quickly. For example, in Yosemite National Park, by 1916, more visitors entered the park by automobile than by train. The following season, the ratio was nearly three to one, and by 1918, the ratio was almost seven to one (Lillard, 1968). By the mid 1950s only 1 to 2 percent of all park visitors entered by public transportation (Long, 1956). This trend has continued through present times.

Current Thinking and Challenges Facing Transportation Planning in the Parks

In recent years, the National Park Service has taken notice of the deleterious effects of automobiles on both park resources and the visitor experience. According to the National Park Service Transportation Planning Workbook (1999), "much has changed in the past 80 years. Parks have become so popular and so readily accessible that many park roads are inundated with increasingly long lines of vehicles. Many NPS facilities and infrastructure are stretched to their limits. Congestion and its accompanying pollution threatens to degrade the visitor experience as well as the priceless natural and cultural resources that have been so carefully preserved."

In response to the challenges facing park managers, the Department of Interior and the Department of Transportation began working together in 1997 to formulate solutions to park transportation issues. The Department of Interior and the Department of Transportation entered into a Memorandum of Understanding in November of 1997 to respond to high visitation levels and the corresponding problems that result from growing volumes of traffic and spiraling demands for visitor parking. The challenge of balancing stewardship of park resources against the pressure for more public access has become increasingly difficult in recent years. The Memorandum of Understanding lays the foundation for developing more comprehensive, intermodal, and financially efficient transportation systems while

addressing the National Park Service's dual mandate of preserving natural and cultural resources and providing for a meaningful, pleasant visitor experience (National Park Service, 2001c).

In 1999, when unveiling Acadia National Park's new alternative transportation system, then Secretary of Interior Bruce Babbitt remarked "Our parks don't have too many people, but they can, and often do, have too many cars. There is almost a tyranny of the automobile, where honking, fumes and hectic search for parking actually limits and inhibits our experience of nature. Two years ago, we sought a better way. Today I'm proud to announce that we've found it." Secretary Babbitt continued "From Yosemite to Yellowstone, to the Grand Canyon and Zion, the Park Service is looking at emerging technology to help fulfill our 83-year-old mandate to provide access to, and preserve unimpaired, our greatest natural resources" (National Park Service, 2001a).

The emerging technologies former secretary Babbitt spoke of were intelligent transportation systems (ITS), and alternative transportation systems (ATS). Some of the strategies and tools used by these systems include:

- Enhanced roadways
- Provision for non-vehicular travel modes
- Enhanced visitor information
- Encouragement of use of alternate travel modes
- Improved "way-finding" signage (ITS)
- Restricted access to roadways
- Iterative Transportation Systems (e.g., buses, light rail)

One of the primary strategies employed by transportation planners thus far in the national parks has been the use of ATS. In a number of parks, including Grand Canyon, Acadia and Zion, plans for ATS have been created, and in some cases, implemented. These systems offer potential solutions to some of the transportation problems that many parks face. For example, by introducing ATS, the number of private automobiles entering parks will be reduced thereby reducing traffic congestion, alleviating parking problems, and reducing adverse impacts created by noise and air pollution. Additionally, opportunities for further interpretation may become available when groups of people are together on a public transportation system.

Linkages between Transportation and Social Carrying Capacity

Since alternative transportation systems can directly affect the number and distribution of park visitors at various attraction sites within a park, implementation of ATS can potentially affect the carrying capacity of parks. Carrying capacity is generally defined as the maximum number of visitors that can be accommodated in a park or related area without unacceptable impacts on park resources or the quality of the visitor experience (Manning, 1999). Contemporary approaches to managing carrying capacity, including Limits of Acceptable Change (LAC) (Stankey et al., 1985) and Visitor Experience and Resource Protection

(VERP) (National Park Service, 1997; Manning, 2001), rely on formulation of indicators and standards of quality. Indicators of quality are measurable, manageable variables that reflect management objectives for resource protection and the quality of the visitor experience. Standards of quality define the minimum acceptable condition of indicator variables. ATS can potentially affect indicators and standards of quality, and ultimately carrying capacity through variations in fleet size (number of vehicles in fleet and capacity of each vehicle), scheduling and routing.

Case Study: Yosemite National Park

In a study of carrying capacity in Yosemite Valley, visitors at the base of Bridalveil Fall were asked questions regarding park conditions that added to or detracted from the quality of the visitor experience (Manning, Valliere, Lawson, Wang & Newman, 1999). The number of persons at one time (PAOT) at the fall emerged as an important indicator of experiential quality. Visitors were also asked to rate the acceptability of a series of computer-generated photographs showing a range of people at the base of the fall. These data provide a basis for helping formulate a standard of quality for PAOT at this site.

A computer simulation model of visitor use of Bridalveil Fall was also developed (Manning et al., 1999). This model was used to estimate PAOT at the base of the fall. Figure 1 traces PAOT over the minutes of a simulated day. Average daily use at Bridalveil Fall is approximately 3,500 visitors, and the simulated day ran from 7:00am (0 minutes) to 8:00pm (780 minutes). The mean PAOT (69) is represented by a horizontal line.

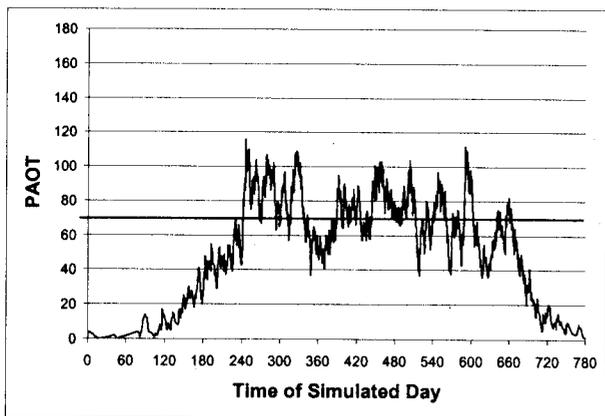


Figure 1. Simulation of Current Conditions at the Base of Bridalveil Fall

Two alternative scenarios were then developed and run using the computer simulation model. These scenarios were designed to simulate visitor use under an ATS. Both scenarios held total daily use of Bridalveil Fall constant at 3,500 visitors, but varied arrival schedules. In the first scenario, visitors arrived in groups of 180 every 30 minutes, and findings from this scenario are plotted in Figure 2. In this scenario, mean PAOT, represented by the

higher horizontal line, increased dramatically to 98. In the second scenario, visitors arrived in groups of 45 every 7.5 minutes, and findings from this scenario are plotted in Figure 3. In this scenario, mean PAOT, represented by the lower horizontal line, decreased to 62.

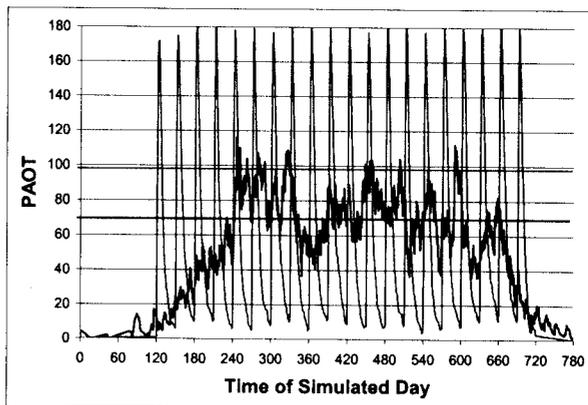


Figure 2. Simulation of Current Conditions and 30 Minute Scheduled ATS at the Base of Bridalveil Fall

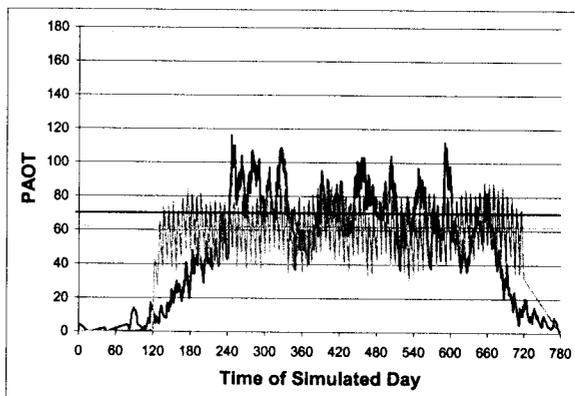


Figure 3. Simulation of Current Conditions and 7.5 Minute Scheduled ATS at the Base of Bridalveil Fall

These results suggest that PAOT, which is a salient indicator of the quality of visitor experience is transportation dependent. Infrequent, large groups can increase average PAOT, thereby effectively decreasing carrying capacity. Further, more frequent, moderately sized groups, can decrease average PAOT, thereby effectively increasing carrying capacity.

Conclusions

Instituting ATS may improve conditions on park roads, but has the potential to both improve and degrade social conditions at park attraction sites. In general, small groups delivered frequently at regular intervals tend to decrease PAOT, while large groups, delivered less frequently, will tend to increase PAOT.

Transportation systems can affect social carrying capacity as measured by indicators of visitor experiential quality. Transportation planners therefore need to carefully consider carrying capacity issues. Integration of transportation planning and social carrying capacity is necessary to institute park planning that does not degrade the quality of the visitor experience. By doing so, park managers can address issues of transportation capacity and social carrying capacity within a single framework. Computer simulation modeling allows manipulation of several dynamic variables at one time (e.g., rate of delivery, group size, scheduling, routing) offering a more comprehensive assessment of potential transportation alternatives, and can be an effective tool integrating transportation planning and social carrying capacity research.

Potential exists for future research into the integration of social carrying capacity and transportation planning. First, applying a variety of transportation scenarios to a park-wide computer simulation model could provide a more complete picture of the interaction between social carrying capacity and transportation systems. Second, inclusion of indicator variables that apply to both transportation planning and social carrying capacity into studies and planning could give managers a broader understanding of how park systems function.

Integration of transportation planning and carrying capacity offers potentially important mutual benefits. Carrying capacity can provide estimates of appropriate use levels at strategic sites within a park, and these data can be used to help design the routing and scheduling of a transportation network. Moreover, an appropriately designed transportation network can be a vital tool in implementing a carrying capacity plan.

References

Bade, W. F. (1924). The life and letters of John Muir. Cambridge, MA: Houghton Mifflin Company.

Lillard, R. (1968). The siege and conquest of a national park. American West, 5, 28-71.

Long, G. W. (1956). Many-splendored glacierland. National Geographic Magazine, 160, 589-590.

Manning, R. (1999). Studies in outdoor recreation. Corvallis: Oregon State University Press.

Manning, R. (2001). Visitor Experience and Resource Protection: A framework for managing the carrying capacity of national parks. Journal of Park and Recreation Administration, 19(1), 93-108.

Manning, R., Lawson, S., Wang, B., & Valliere, W. (1998). Research to support visitor management at Alcatraz Island: Study completion report. Burlington, VT: School of Natural Resources.

Manning, R., Valliere, W., Lawson, S., Wang, B., & Newman, P. (1999). Carrying capacity research for Yosemite Valley: Phase II study. Burlington, VT: School of Natural Resources.

National Park Service (1997). VERP: The Visitor Experience and Resource Protections (VERP) Framework – A handbook for planners and managers. Denver, CO: Denver Service Center.

National Park Service. (1999). National Park Service transportation planning workbook. [On-line] Available: <http://www.nps.gov/transportation/alt/guidebook/index.htm>

National Park Service. (2001a). Babbitt announces test project, shifts transportation options for National Parks into overdrive: Acadia National Park selected as test site for Intelligent Transportation Systems. [On-line] Available: <http://www.its.dot.gov/rural/philanr.htm>.

National Park Service. (2001b). Frequently asked questions about The National Park Service. [On-line] Available: http://www.nps.gov/pub_aff/e-mail/faqs.htm.

National Park Service. (2001c). Intelligent Transportation Systems. [On-line] Available: <http://www.nps.gov/transportation/its.htm>.

Runte, A. (1997). National Parks: The American experience. NE: University of Nebraska Press.

Stankey, G., Cole, D., Lucas, R., Peterson, M., Frissell, S., & Washburne, R. (1985). The Limits of Acceptable Change (LAC) system for wilderness planning (Gen. Tech. Rep. INT-176). USDA, Forest Service.